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

SAR EVALUATION REPORT

For

UMTS(850/1900)/(E)GPRS (850/1900) w/ 1TX ant.+LTE (B2/4/5/17, 1 TX ant.) USB modem

Model: AC340U
FCC ID: N7NAC340U

Report Number: 12U14542-4B1
Issue Date: 12/20/2012

Prepared for

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	11/01/2012	Initial issue	--
A	11/09/2012	Updated the Report based on the Reviewer's comments: 1. Sec. Nos. 12.1, 12.2, 12.3, and 12.4: Revised Note for referencing Test Reduction based on KDB 447498. 2. Sec. 13.1: Added LTE Band 17 note for exclusion in Repeated SAR Testing.	Bobby Bayani
B	11/28/2012	Updated the Report based on the Reviewer's comments: 1. Sec. 1: Changed "Horizontal-Down" to "Horizontal-Up" in *Highest Reported SAR* section. 2. Sec. 2: Added note below KDB's 3. Sec. 8: Added diagram of USB connector orientations implemented on laptop computer per *447498 D02 SAR Procedures for Dongle Xmtr v02*. 4. Sec. 12: Changed "Horizontal-Down" to "Horizontal-Up" in *Test Position* on all tables. Moved corresponding data to match correct *Test Position*. 5. Sec. 13: Changed "Horizontal-Down" to "Horizontal-Up" in *Test Configuration* in all tables. 6. Sec. 13.2: Changed "Horizontal-Down" SAR plots to "Horizontal-Up" SAR plots. 7. Sec. 14: Updated SAR test plots (Sec. 14.2 - 14.10.) in the appendix. 8. Sec. 16: Added an additional antenna dimensions diagram. 9. Sec. 17: Photos of Normal Operation Configurations 10. Sec. 18: Inserted correct photos to correspond to the correct configurations.	Sunny Shih
B1	12/20/2012	1. Sec. 18: Updated Photo.	Bobby Bayani

Table of Contents

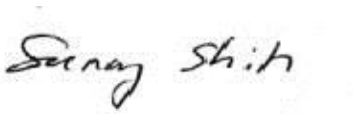
1. Attestation of Test Results

Applicant	SIERRA WIRELESS INC.		
DUT description	UMTS(850/1900)/(E)GPRS (850/1900) w/ 1TX ant.+LTE (B2/4/5/17, 1 TX ant.) USB modem		
Model	AC340U		
Test device is	An identical prototype		
Device category	Portable		
Exposure category	General Population/Uncontrolled Exposure		
Date tested	10/3/2012 - 10/19/2012		
RF Exposure Rule	Freq. Range	Highest Reported SAR	Limit
22	824-849 MHz	1.417 W/kg (Horizontal-Up w/ 5mm distance)	1.6 W/kg
24	1850-1910 MHz	1.415 W/kg (Horizontal-Up w/ 5mm distance)	
27 (LTE Band 2)	1850-1910 MHz	1.210 W/kg (Horizontal-Up w/ 5mm distance)	
27 (LTE Band 4)	1710–1755 MHz	0.962 W/kg (Horizontal-Up w/ 5mm distance)	
27 (LTE Band 5)	824-849 MHz	1.080 W/kg (Horizontal-Up w/ 5mm distance)	
27 (LTE Band 17)	704–716 MHz	1.009 W/kg (Horizontal-Up w/ 5mm distance)	
Applicable Standards			Test Results
Published RF exposure KDB procedures, TCB workshop updates and OET Bulletin 65 Supplement C, IEEE Std 1528-2003 and IEEE Std 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:



Sunny Shih
Engineering Leader
UL CCS

Prepared By:

Bobby Bayani
SAR Engineer
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, IEEE Std 1528a-2005 and the following published RF exposure KDB procedures:

- 941225 D01 SAR test for 3G devices v02
- 941225 D03 SAR Test Reduction GSM GPRS EDGE v01
- 941225 D05 SAR for LTE Devices v02
- 447498 D01 General RF Exposure Guidance v05
- 447498 D02 SAR Procedures for Dongle Xmtr v02
- 865664 D01 SAR measurement 100 MHz to 6 GHz v01
- 865664 D02 SAR Reporting v01
- KDB Inquiry: Tracking Number 418228

Note: Please see below for the requested PBA inquiry numbers relative to each model.
AC250U: Received direction & guidance from FCC, KDB inquiry # 300569
AC313U: Received direction & guidance from FCC, KDB inquiry # 698964
AC330U: No KDB number, followed model AC313
AC340U (current device): Received response from the FCC (Tracking Number 418228) confirming the ability to use guidance from previous inquiries due to the similarities between AC340U and AC250, AC313U/AC330U (all use the same hinge & articulation scheme).

3. Facilities and Accreditation

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

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

4. Calibration and Uncertainty

4.1. Measuring Instrument Calibration

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

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due date		
				MM	DD	Year
S-Parameter Network Analyzer	Agilent	8753ES	MY40001647	6	27	2013
Dielectronic Probe kit	HP	85070C	2569	N/A		
ENA Series Network Analyzer	Agilent	E5071B	MY42100131	2	11	2013
Dielectronic Probe kit	HP	85070E	594	N/A		
Synthesized Signal Generator	HP	8665B	3438A00633	2	22	2013
Power Meter	HP	438A	3513U04320	9	17	2013
Power Sensor A	HP	8481A	2237A31744	8	17	2013
Power Sensor B	HP	8481A	3318A95392	8	17	2013
Amplifier	MITEQ	4D00400600-50-30P	1622052	N/A		
Directional coupler	Werlatone	C8060-102	2149	N/A		
Synthesized Signal Generator	HP	8665B	3744A01084	5	3	2013
Power Meter	HP	438A	2822A05684	10	7	2013
Power Sensor A	HP	8481A	2702A66876	8	1	2013
Power Sensor B	HP	8482A	2349A08568	4	14	2013
Amplifier	MITEQ	4D00400600-50-30P	1620606	N/A		
Directional coupler	Werlatone	C8060-102	2141	N/A		
Base Station Simulator	Agilent	8960	GB42361452	4	4	2013
Base Station Simulator	R & S	CMU200	118339	5	20	2013
Base Station Simulator	R & S	CMW500	104245	12	11	2012
Thermometer	ERTCO	639-1S	8350	7	30	2013
E-Field Probe	SPEAG	EX3DV4	3871	8	20	2013
Data Acquisition Electronics	SPEAG	DAE4	1343	8	20	2013
System Validation Dipole	SPEAG	D750V3	1019	2	9	2013
System Validation Dipole	SPEAG	D835V2	4d002	3	6	2013
System Validation Dipole	SPEAG	D835V2	4d117	4	10	2013
System Validation Dipole	SPEAG	D1750V2	1050	4	19	2013
System Validation Dipole	SPEAG	D1900V2	5d140	4	12	2013

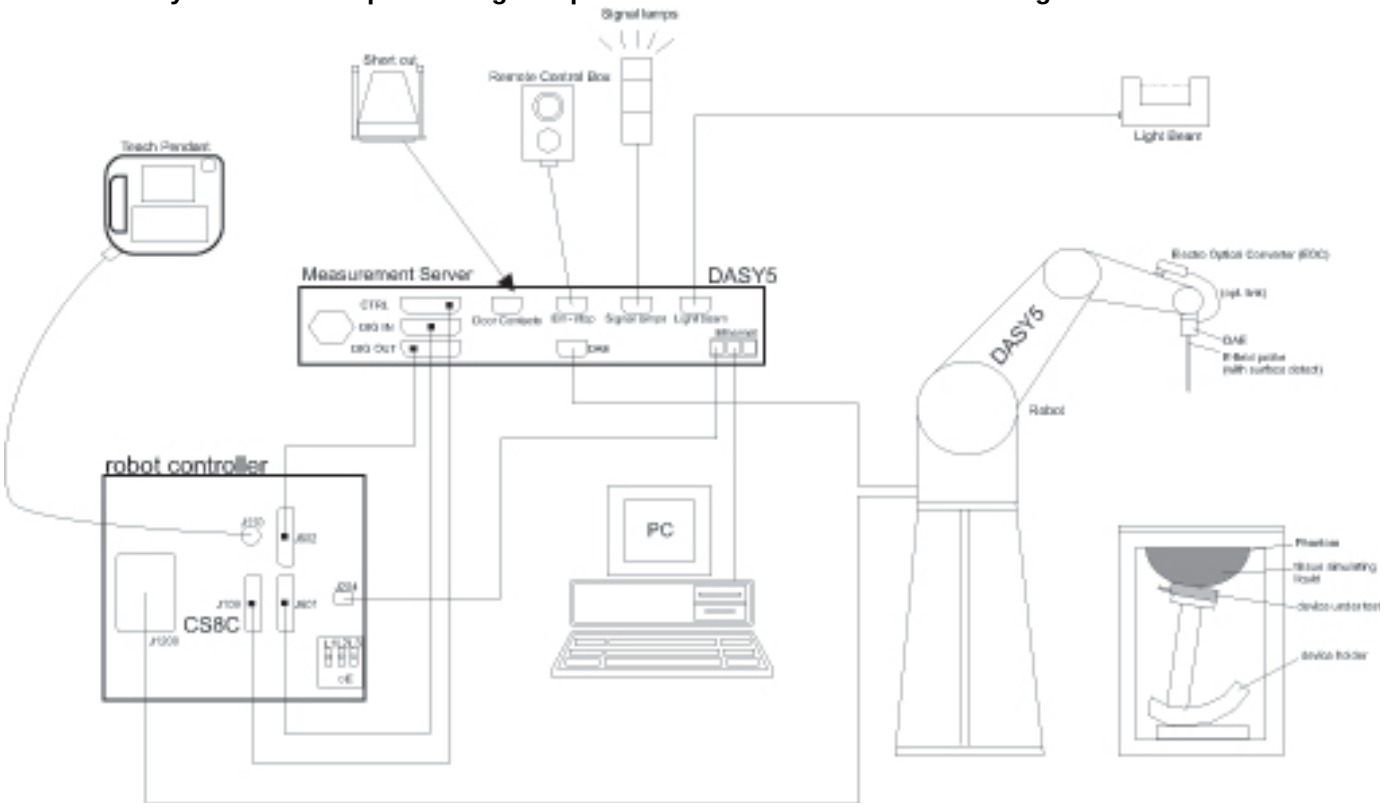
4.2. Measurement Uncertainty

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

Component	Error, %	Distribution	Divisor	Sensitivity	U (Xi), %
Measurement System					
Probe Calibration (k=1)	**6.00**	Normal	1	1	6.00
Axial Isotropy	1.15	Rectangular	1.732	0.7071	0.47
Hemispherical Isotropy	2.30	Rectangular	1.732	0.7071	0.94
Boundary Effect	0.90	Rectangular	1.732	1	0.52
Probe Linearity	3.45	Rectangular	1.732	1	1.99
System Detection Limits	1.00	Rectangular	1.732	1	0.58
Readout Electronics	0.30	Normal	1	1	0.30
Response Time	0.80	Rectangular	1.732	1	0.46
Integration Time	2.60	Rectangular	1.732	1	1.50
RF Ambient Conditions - Noise	3.00	Rectangular	1.732	1	1.73
RF Ambient Conditions - Reflections	3.00	Rectangular	1.732	1	1.73
Probe Positioner Mechanical Tolerance	0.40	Rectangular	1.732	1	0.23
Probe Positioning with respect to Phantom	2.90	Rectangular	1.732	1	1.67
Extrapolation, Interpolation and Integration	1.00	Rectangular	1.732	1	0.58
Test Sample Related					
Test Sample Positioning	2.90	Normal	1	1	2.90
Device Holder Uncertainty	3.60	Normal	1	1	3.60
Output Power Variation - SAR Drift	5.00	Rectangular	1.732	1	2.89
Phantom and Tissue Parameters					
Phantom Uncertainty (shape and thickness)	4.00	Rectangular	1.732	1	2.31
Liquid Conductivity - deviation from target	5.00	Rectangular	1.732	0.64	1.85
Liquid Conductivity - measurement	**-4.83**	Normal	1	0.64	-3.09
Liquid Permittivity - deviation from target	5.00	Rectangular	1.732	0.6	1.73
Liquid Permittivity - measurement uncertainty	**-4.72**	Normal	1	0.6	-2.83
				Combined Standard Uncertainty Uc(y) =	10.60
				Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =	21.21 %
				Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =	1.67 dB

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.

6. SAR Measurement Procedure

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.

Area Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	½·δ·ln(2) ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}	≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
	When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

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 points (refer to table below) 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.

Zoom Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01 (Draft)

			≤ 3 GHz	> 3 GHz
Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}			≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	≤ 1.5·$\Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm

Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.

* When zoom scan is required and the *reported* SAR from the area scan based *1-g SAR estimation* procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.

Step 4: Power drift measurement

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

Step 5: Z-Scan (FCC only)

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

6.2. Volume Scan Procedures

Step 1: Repeat Step 1-4 in Section 6.1

Step 2: 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 3: Power drift measurement
The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

7. Device Under Test

UMTS(850/1900)/(E)GPRS (850/1900) w/ 1TX ant.+LTE (B2/4/5/17, 1 TX ant.) USB modem Model: AC340U	
Operating Configuration(s)	- USB Plugged to the Host Device
Exposure Condition(s)	- Horizontal Up, Horizontal Down, Vertical Front, Vertical Back, and Bottom Tip
Duty Cycle	- GPRS 2 Slots: 25% - W-CDMA: 100% - LTE: 100%

7.1. Wireless Technologies

Wireless Mode and Frequency Bands	- GSM850/GSM1900 - W-CDMA Band V/II - LTE Band 2/4/5/17
Modulation	▪ GPRS (Class 10)/EGPRS (Class 12) ▪ W-CDMA Rel 99/HSDPA (Rel 7, CAT 14)/HSUPA (Rel 6, CAT 6)

7.2. Hotspot (Wireless Router) Exposure Condition

N/A

7.3. Simultaneous Transmission Condition

N/A

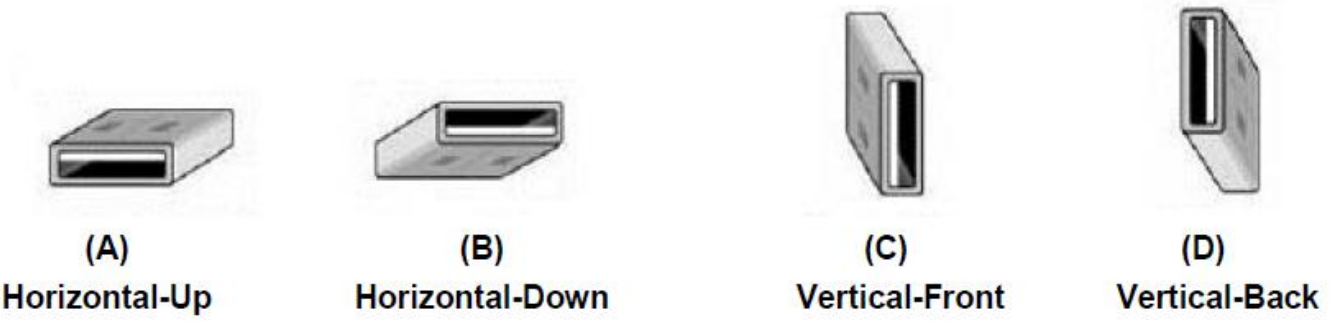
7.1. KDB 941225 D05 SAR for LTE Devices v02

<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>Frequency range, Channel Bandwidth, Numbers and Frequencies</td><td>
<table>
<tr><td colspan="3">Band 2</td></tr>
<tr><td colspan="2">Tx: 1850 - 1910 MHz</td><td>Rx: 1930 - 1990 MHz</td></tr>
<tr><td colspan="3">Band 4</td></tr>
<tr><td colspan="2">Tx: 1710 – 1755 MHz</td><td>Rx: 2100 – 2155 MHz</td></tr>
<tr><td colspan="3">Band 5</td></tr>
<tr><td colspan="2">Tx: 824 - 849 MHz</td><td>Rx: 869 - 894 MHz</td></tr>
<tr><td colspan="3">Band 17</td></tr>
<tr><td colspan="2">Tx: 704 – 716 MHz</td><td>Rx: 734 – 746 MHz</td></tr>
<tr><td rowspan="2">Band 2</td><td colspan="2">Channel Bandwidth</td></tr>
<tr><td>10 MHz</td><td>5 MHz</td></tr>
<tr><td>Low</td><td>18650/1855</td><td>18625/1852.5</td></tr>
<tr><td>Mid</td><td>18900/1880</td><td>18900/1880</td></tr>
<tr><td>High</td><td>19150/1905</td><td>19175/1907.5</td></tr>
<tr><td rowspan="2">Band 4</td><td colspan="2">Channel Bandwidth</td></tr>
<tr><td>10 MHz</td><td>5 MHz</td></tr>
<tr><td>Low</td><td>20000/1715</td><td>19975/1712.5</td></tr>
<tr><td>Mid</td><td>20175/1732.5</td><td>20175/1732.5</td></tr>
<tr><td>High</td><td>20350/1750</td><td>20375/1752.5</td></tr>
<tr><td rowspan="2">Band 5</td><td colspan="2">Channel Bandwidth</td></tr>
<tr><td>10 MHz</td><td>5 MHz</td></tr>
<tr><td>Low</td><td>20450/829</td><td>20425/826.5</td></tr>
<tr><td>Mid</td><td>20525/836.5</td><td>20525/836.5</td></tr>
<tr><td>High</td><td>20600/844</td><td>20625/846.5</td></tr>
<tr><td rowspan="2">Band 17</td><td colspan="2">Channel Bandwidth</td></tr>
<tr><td>10 MHz</td><td>5 MHz</td></tr>
<tr><td>Low</td><td>23780/709</td><td>23755/706.5</td></tr>
<tr><td>Mid</td><td>23790/710</td><td>23790/710</td></tr>
<tr><td>High</td><td>23800/711</td><td>23825/713.5</td></tr>
</table>
</td></tr>
<tr><td>LTE transmitter and antenna implementation</td><td>A single antenna is used for LTE and other wireless modes (GPRS/EGPRS/UMTS) for both Transmit and Receive.
A Secondary antenna is used for LTE and other wireless modes (GPRS/EGPRS/UMTS) for Receive Only.</td></tr>
<tr><td>Maximum power reduction (MPR)</td><td>
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 Built-in by design
A-MPR (additional MPR) was disabled during SAR testing
</td></tr>
<tr><td>Power reduction</td><td>N/A</td></tr>
<tr><td>Spectrum plots for RB configurations</td><td>N/A</td></tr>
</table>

8. Summary of Test Configurations

Refer to Sec. 16 Antenna Dimensions and Separation Distances and Sec. 17. Photos of Normal Operation Configurations

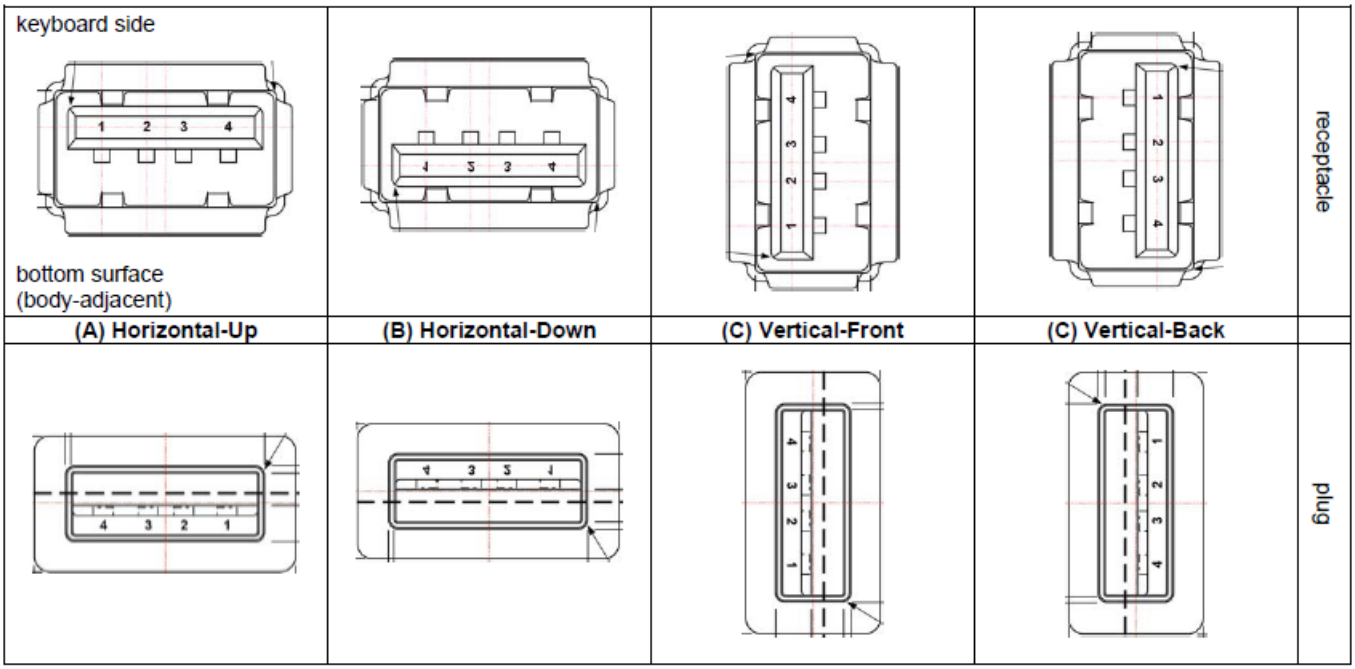
Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Horizontal-Up (A)	5 mm	Yes	
Horizontal-Down (B)	5 mm	Yes	
Vertical-Front (C)	5 mm	Yes	
Vertical-Back (D)	5 mm	Yes	
Bottom Tip	5 mm	Yes	
Tip	5 mm	No	SAR is not required because the distance from the antenna to the tip of the dongle is > 1 cm as per KDB 447498 D02 SAR Procedures for Dongle Xmtr v02



(A) Horizontal-Up **(B) Horizontal-Down** **(C) Vertical-Front** **(D) Vertical-Back**

These are USB connector orientations on laptop computers; USB dongles have the reverse configuration for plugging into the corresponding laptop computers.

USB Connector Orientations Implemented on Laptop Computers



9. RF Output Power Measurement

9.1. GSM850

Target Power:

GPRS 1 slot 32.0 dBm
GPRS 2 slot 31.0 dBm

EGPRS 1 slot 26.0 dBm
EGPRS 2 slot 26.0 dBm

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

GPRS (GMSK) - Coding Scheme: CS1

Band	Ch No.	Freq. (MHz)	Avg burst Pwr (dBm)			
			1 slot	Frame Avg Pwr	2 slots	Frame Avg Pwr
850	128	824.2	32.5	23.5	**30.9**	24.9
	190	836.6	32.4	23.4	**31.3**	25.3
	251	848.8	32.4	23.4	**31.4**	25.4

EGPRS (8PSK) - Coding Scheme: MCS5

Band	Ch No.	Freq. (MHz)	Avg burst Pwr (dBm)				Avg burst Pwr (dBm)			
			1 slot	Frame Avg Pwr	2 slots	Frame Avg Pwr	3 slots	Frame Avg Pwr	4 slots	Frame Avg Pwr
850	128	824.2	27.0	18.0	26.9	20.9	26.8	22.6	26.6	23.6
	190	836.6	27.0	18.0	26.9	20.9	26.8	22.5	26.6	23.6
	251	848.8	27.0	18.0	27.0	21.0	26.8	22.5	26.7	23.7

Notes:

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

- GMSK (GPRS) mode with 2 time slots, based on the output power measurements above
- SAR is not required for EGPRS (8PSK) Mode because its output power is less than that of GPRS Mode

9.2. GSM1900

Target Power:

GPRS 1 slot 30.0 dBm
GPRS 2 slot 29.0 dBm

EGPRS 1 slot 25.0 dBm
EGPRS 2 slot 25.0 dBm

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

GPRS (GMSK) - Coding Scheme: CS1

Band	Ch No.	Freq. (MHz)	Avg burst Pwr (dBm)			
			1 slot	Frame Avg Pwr	2 slots	Frame Avg Pwr
1900	512	1850.2	29.8	20.7	**29.3**	23.3
	661	1880.0	29.6	20.6	**29.6**	23.5
	810	1909.8	30.0	20.9	**29.5**	23.5

EGPRS (8PSK) - Coding Scheme: MCS5

Band	Ch No.	Freq. (MHz)	Avg burst Pwr (dBm)				Avg burst Pwr (dBm)			
			1 slot	Frame Avg Pwr	2 slots	Frame Avg Pwr	3 slots	Frame Avg Pwr	4 slots	Frame Avg Pwr
1900	512	1850.2	26.0	17.0	25.8	19.8	25.7	21.4	25.6	22.6
	661	1880.0	26.0	17.0	25.8	19.7	25.6	21.4	25.5	22.5
	810	1909.8	26.0	17.0	25.8	19.7	25.6	21.4	25.5	22.5

Notes:

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

- GMSK (GPRS) mode with 2 time slots, based on the output power measurements above
- SAR is not required for EGPRS (8PSK) Mode because its output power is less than that of GPRS Mode

9.3. W-CDMA (UMTS) Band V

Target Power: 23.0 dBm
Tune-up Tolerance: -1.0 dB / +1.0 dB

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)	Avg Pwr (dBm)
W-CDMA (UMTS) Band V	Rel 99 (RMC, 12.2 kbps)	4132	826.4	23.4
		4182	836.6	23.4
		4233	846.6	23.5

HSDPA

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

	Mode	HSDPA	HSDPA	HSDPA	HSDPA
	Subtest	1	2	3	4
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)	Avg Pwr (dBm)
W-CDMA (UMTS) Band V	Subtest 1	4132	826.4	22.4
		4182	836.6	22.4
		4233	846.6	22.4
	Subtest 2	4132	826.4	22.4
		4182	836.6	22.4
		4233	846.6	22.3
	Subtest 3	4132	826.4	21.7
		4182	836.6	21.9
		4233	846.6	21.8
	Subtest 4	4132	826.4	21.9
		4182	836.6	21.9
		4233	846.6	21.8

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.

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	

Results

Band	Mode	UL Ch No.	Freq. (MHz)	Avg Pwr (dBm)
WCDMA (UMTS) Band V	Subtest 1	4132	826.4	21.2
		4182	836.6	21.1
		4233	846.6	21.4
	Subtest 2	4132	826.4	21.1
		4182	836.6	21.1
		4233	846.6	21.2
	Subtest 3	4132	826.4	20.4
		4182	836.6	20.4
		4233	846.6	20.6
	Subtest 4	4132	826.4	21.6
		4182	836.6	22.0
		4233	846.6	22.0
	Subtest 5	4132	826.4	20.7
		4182	836.6	20.8
		4233	846.6	20.8

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.

9.4. W-CDMA (UMTS) Band II

Target Power: 22.0 dBm
Tune-up Tolerance: -1.0 dB / +1.0 dB

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)	Avg Pwr (dBm)
W-CDMA (UMTS) Band II	Rel 99 (RMC, 12.2 kbps)	9262	1852.4	22.5
		9400	1880.0	22.4
		9538	1907.6	22.5

HSDPA

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

	Mode	HSDPA	HSDPA	HSDPA	HSDPA
	Subtest	1	2	3	4
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)	Avg Pwr (dBm)
W-CDMA (UMTS) Band II	Subtest 1	9262	1852.4	21.5
		9400	1880.0	21.5
		9538	1907.6	21.7
	Subtest 2	9262	1852.4	21.5
		9400	1880.0	21.5
		9538	1907.6	21.7
	Subtest 3	9262	1852.4	21.0
		9400	1880.0	20.9
		9538	1907.6	21.0
	Subtest 4	9262	1852.4	20.9
		9400	1880.0	20.9
		9538	1907.6	21.0

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.

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	

Results

Band	Mode	UL Ch No.	Freq. (MHz)	Avg Pwr (dBm)
WCDMA (UMTS) Band II	Subtest 1	9262	1852.4	20.9
		9400	1880.0	20.9
		9538	1907.6	20.7
	Subtest 2	9262	1852.4	20.4
		9400	1880.0	20.3
		9538	1907.6	20.4
	Subtest 3	9262	1852.4	19.6
		9400	1880.0	20.3
		9538	1907.6	20.3
	Subtest 4	9262	1852.4	20.9
		9400	1880.0	20.4
		9538	1907.6	21.0
	Subtest 5	9262	1852.4	21.1
		9400	1880.0	21.0
		9538	1907.6	21.0

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.

9.5. LTE Band 2

Target Power: 22.0 dBm
Tune-up Tolerance: -1.0 dB / +1.0 dB

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 Signaling 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.					

Results

BW	Ch	Freq. (MHz)	Mode	UL RB Allocation	UL RB Start	Target MPR	Avg Pwr (dBm)
10	18650	1855.0	QPSK	1	0	0	22.9
				1	24	0	22.8
				1	49	0	22.8
				25	0	1	21.9
				25	12	1	21.8
				25	24	1	21.9
				50	0	1	21.8
			16QAM	1	0	1	22.4
				1	24	1	21.4
				1	49	1	22.4
				25	0	2	20.9
				25	12	2	20.8
				25	24	2	20.9
				50	0	2	20.8
	18900	1880.0	QPSK	1	0	0	23.0
				1	24	0	22.8
				1	49	0	22.8
				25	0	1	21.9
				25	12	1	21.7
				25	24	1	21.6
				50	0	1	21.8
			16QAM	1	0	1	21.7
				1	24	1	21.7
				1	49	1	21.7
				25	0	2	20.8
				25	12	2	20.8
				25	24	2	20.8
				50	0	2	20.7
	19150	1905.0	QPSK	1	0	0	22.7
				1	24	0	22.7
				1	49	0	23.0
				25	0	1	21.9
				25	12	1	21.8
				25	24	1	21.7
				50	0	1	21.8
			16QAM	1	0	1	21.5
				1	24	1	21.5
				1	49	1	21.5
				25	0	2	20.6
				25	12	2	20.6
				25	24	2	20.5
				50	0	2	20.5

LTE Band 2 Results (continued)

BW (MHz)	Ch	Freq. (MHz)	Mode	UL RB Allocation	UL RB Start	MPR	Avg Pwr (dBm)
5	18625	1855.0	QPSK	1	0	0	22.8
				1	12	0	22.9
				1	24	0	22.8
				12	0	1	21.9
				12	6	1	21.9
				12	11	1	21.9
				25	0	1	21.8
			16QAM	1	0	1	21.4
				1	12	1	21.5
				1	24	1	21.4
				12	0	2	20.7
				12	6	2	20.8
				12	11	2	20.9
				25	0	2	20.8
	18900	1880.0	QPSK	1	0	0	22.5
				1	12	0	22.7
				1	24	0	22.6
				12	0	1	21.8
				12	6	1	21.8
				12	11	1	21.8
				25	0	1	21.7
			16QAM	1	0	1	21.7
				1	12	1	21.7
				1	24	1	21.7
				12	0	2	20.8
				12	6	2	20.8
				12	11	2	20.8
				25	0	2	20.8
	19175	1907.5	QPSK	1	0	0	22.3
				1	12	0	22.6
				1	24	0	22.4
				12	0	1	21.8
				12	6	1	21.8
				12	11	1	21.7
				25	0	1	21.7
			16QAM	1	0	1	21.6
				1	12	1	21.7
				1	24	1	21.7
				12	0	2	20.8
				12	6	2	20.8
				12	11	2	20.8
				25	0	2	20.8

9.6. LTE Band 4

Target Power: 22.0 dBm
Tune-up Tolerance: -1.0 dB / +1.0 dB

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 Signaling 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.					

Results

BW (MHz)	Ch	Freq. (MHz)	Mode	UL RB Allocation	UL RB Start	MPR	Avg Pwr (dBm)
10	20000	1715.0	QPSK	1	0	0	22.4
				1	24	0	22.4
				1	49	0	22.4
				25	0	1	21.2
				25	12	1	21.4
				25	24	1	21.4
				50	0	1	21.3
			16QAM	1	0	1	20.9
				1	24	1	21.0
				1	49	1	20.9
				25	0	2	20.3
				25	12	2	20.4
				25	24	2	20.5
				50	0	2	20.4
	20175	1732.5	QPSK	1	0	0	22.5
				1	24	0	22.5
				1	49	0	22.6
				25	0	1	21.3
				25	12	1	21.4
				25	24	1	21.4
				50	0	1	21.3
			16QAM	1	0	1	21.2
				1	24	1	21.3
				1	49	1	21.3
				25	0	2	20.3
				25	12	2	20.4
				25	24	2	20.4
				50	0	2	20.3
	20350	1750.0	QPSK	1	0	0	22.6
				1	24	0	22.5
				1	49	0	22.5
				25	0	1	21.3
				25	12	1	21.3
				25	24	1	21.2
				50	0	1	21.3
			16QAM	1	0	1	21.1
				1	24	1	21.1
				1	49	1	21.1
				25	0	2	20.1
				25	12	2	20.2
				25	24	2	20.1
				50	0	2	20.2

LTE Band 4 Results (continued)

BW (MHz)	Ch	Freq. (MHz)	Mode	UL RB Allocation	UL RB Start	MPR	Avg Pwr (dBm)
5	20000	1715.0	QPSK	1	0	0	22.4
				1	24	0	22.3
				1	49	0	22.4
				25	0	1	21.4
				25	12	1	21.4
				25	24	1	21.3
				50	0	1	21.3
			16QAM	1	0	1	21.0
				1	24	1	21.0
				1	49	1	21.0
				25	0	2	20.3
				25	12	2	20.3
				25	24	2	20.3
				50	0	2	20.3
	20175	1732.5	QPSK	1	0	0	22.4
				1	24	0	22.5
				1	49	0	22.6
				25	0	1	21.5
				25	12	1	21.5
				25	24	1	21.5
				50	0	1	21.4
			16QAM	1	0	1	21.4
				1	24	1	21.5
				1	49	1	21.5
				25	0	2	20.5
				25	12	2	20.5
				25	24	2	20.5
				50	0	2	20.5
	20350	1750.0	QPSK	1	0	0	22.4
				1	24	0	22.3
				1	49	0	22.4
				25	0	1	21.4
				25	12	1	21.4
				25	24	1	21.4
				50	0	1	21.3
			16QAM	1	0	1	20.9
				1	24	1	20.9
				1	49	1	20.9
				25	0	2	20.5
				25	12	2	20.6
				25	24	2	20.5
				50	0	2	20.4

9.7. LTE Band 5

Target Power: 23.0 dBm
Tune-up Tolerance: -1.0 dB / +1.0 dB

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 Signaling 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.					

Results

BW (MHz)	Ch	Freq. (MHz)	Mode	UL RB Allocation	UL RB Start	MPR	Avg Pwr (dBm)
10	20450	829.0	QPSK	1	0	0	23.1
				1	24	0	23.0
				1	49	0	23.0
				25	0	1	22.1
				25	12	1	22.0
				25	24	1	21.9
				50	0	1	22.0
			16QAM	1	0	1	21.6
				1	24	1	21.5
				1	49	1	21.5
				25	0	2	21.2
				25	12	2	21.0
				25	24	2	21.0
				50	0	2	21.0
	20525	836.5	QPSK	1	0	0	23.2
				1	24	0	23.2
				1	49	0	23.0
				25	0	1	22.0
				25	12	1	22.1
				25	24	1	22.1
				50	0	1	22.1
			16QAM	1	0	1	21.9
				1	24	1	21.9
				1	49	1	21.8
				25	0	2	21.1
				25	12	2	21.1
				25	24	2	21.2
				50	0	2	21.1
	20600	844.0	QPSK	1	0	0	23.1
				1	24	0	23.0
				1	49	0	22.9
				25	0	1	21.8
				25	12	1	22.0
				25	24	1	22.0
				50	0	1	21.9
			16QAM	1	0	1	21.6
				1	24	1	21.7
				1	49	1	21.6
				25	0	2	20.7
				25	12	2	20.8
				25	24	2	20.8
				50	0	2	20.8

LTE Band 5 Results (continued)

BW (MHz)	Ch	Freq. (MHz)	Mode	UL RB Allocation	UL RB Start	MPR	Avg Pwr (dBm)
5	20425	826.5	QPSK	1	0	0	23.1
				1	12	0	23.1
				1	24	0	23.1
				12	0	1	22.1
				12	6	1	22.1
				12	11	1	22.1
				25	0	1	22.1
			16QAM	1	0	1	22.0
				1	12	1	21.9
				1	24	1	21.9
				12	0	2	21.1
				12	6	2	21.1
				12	11	2	21.1
				25	0	2	21.1
	20525	836.5	QPSK	1	0	0	23.0
				1	12	0	23.2
				1	24	0	23.1
				12	0	1	22.2
				12	6	1	22.2
				12	11	1	22.2
				25	0	1	22.1
			16QAM	1	0	1	21.5
				1	12	1	21.7
				1	24	1	21.6
				12	0	2	21.1
				12	6	2	21.1
				12	11	2	21.1
				25	0	2	21.1
	20625	846.5	QPSK	1	0	0	22.8
				1	12	0	22.8
				1	24	0	22.7
				12	0	1	22.1
				12	6	1	22.1
				12	11	1	22.0
				25	0	1	22.0
			16QAM	1	0	1	21.5
				1	12	1	21.5
				1	24	1	21.4
				12	0	2	21.1
				12	6	2	21.2
				12	11	2	21.2
				25	0	2	21.0

9.8. LTE Band 17

Target Power: 23.0 dBm
Tune-up Tolerance: -1.0 dB / +1.0 dB

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 Signaling 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.					

Results

BW (MHz)	Ch	Freq. (MHz)	Mode	UL RB Allocation	UL RB Start	MPR	Avg Pwr (dBm)
10	23780	709.0	QPSK	1	0	0	22.6
				1	24	0	23.0
				1	49	0	22.9
				25	0	1	21.8
				25	12	1	21.9
				25	24	1	22.1
				50	0	1	21.8
			16QAM	1	0	1	21.1
				1	24	1	21.5
				1	49	1	21.4
				25	0	2	20.8
				25	12	2	20.7
				25	24	2	21.1
				50	0	2	20.9
	23790	710.0	QPSK	1	0	0	22.6
				1	24	0	22.7
				1	49	0	22.7
				25	0	1	21.7
				25	12	1	21.8
				25	24	1	21.7
				50	0	1	21.7
			16QAM	1	0	1	21.4
				1	24	1	21.9
				1	49	1	21.5
				25	0	2	20.6
				25	12	2	20.8
				25	24	2	20.7
				50	0	2	20.7
	23800	711.0	QPSK	1	0	0	22.9
				1	24	0	23.2
				1	49	0	22.4
				25	0	1	22.0
				25	12	1	22.1
				25	24	1	21.8
				50	0	1	21.9
			16QAM	1	0	1	21.5
				1	24	1	21.8
				1	49	1	20.9
				25	0	2	21.0
				25	12	2	21.0
				25	24	2	20.7
				50	0	2	20.9

LTE Band 17 Results (continued)

BW (MHz)	Ch	Freq. (MHz)	Mode	UL RB Allocation	UL RB Start	MPR	Avg Pwr (dBm)
5	23755	706.5	QPSK	1	0	0	22.7
				1	12	0	22.8
				1	24	0	23.0
				12	0	1	21.8
				12	6	1	21.8
				12	11	1	21.9
				25	0	1	21.8
			16QAM	1	0	1	21.2
				1	12	1	21.4
				1	24	1	21.4
				12	0	2	21.2
				12	6	2	21.1
				12	11	2	21.3
				25	0	2	21.3
	23790	710.0	QPSK	1	0	0	22.9
				1	12	0	23.1
				1	24	0	23.1
				12	0	1	22.1
				12	6	1	22.2
				12	11	1	22.0
				25	0	1	22.1
			16QAM	1	0	1	21.8
				1	12	1	22.1
				1	24	1	21.9
				12	0	2	21.0
				12	6	2	21.2
				12	11	2	21.1
				25	0	2	21.1
	23825	713.5	QPSK	1	0	0	23.2
				1	12	0	23.0
				1	24	0	22.4
				12	0	1	22.2
				12	6	1	21.9
				12	11	1	21.8
				25	0	1	21.8
			16QAM	1	0	1	21.6
				1	12	1	21.8
				1	24	1	21.3
				12	0	2	21.0
				12	6	2	20.8
				12	11	2	20.8
				25	0	2	20.8

10. Tissue Dielectric Properties

IEEE Std 1528-2003 Table 2

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

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

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

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

Ingredients (% by weight)	Frequency (MHz)									
	450		835		915		1900		2450	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	38.56	51.16	41.45	52.4	41.05	56.0	54.9	40.4	62.7	73.2
Salt (NaCl)	3.95	1.49	1.45	1.4	1.35	0.76	0.18	0.5	0.5	0.04
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	58.0	0.0	0.0
HEC	0.98	0.52	1.0	1.0	1.0	1.21	0.0	1.0	0.0	0.0
Bactericide	0.19	0.05	0.1	0.1	0.1	0.27	0.0	0.1	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8	0.0
DGBE	0.0	0.0	0.0	0.0	0.0	0.0	44.92	0.0	0.0	26.7
Dielectric Constant	43.42	58.0	42.54	56.1	42.0	56.8	39.9	54.0	39.8	52.5
Conductivity (S/m)	0.85	0.83	0.91	0.95	1.0	1.07	1.42	1.45	1.88	1.78

Salt: 99+% Pure Sodium Chloride Sugar: 98+% Pure Sucrose
Water: De-ionized, 16 MΩ+ resistivity HEC: Hydroxyethyl Cellulose
DGBE: 99+% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]
Triton X-100 (ultra pure): Polyethylene glycol mono [4-(1,1, 3, 3-tetramethylbutyl)phenyl]ether

MSL/HSL1750 (Body and Head liquids for 1700 – 1800 MHz)

Item	Head Tissue Simulation Liquids HSL1750 Muscle (body) Tissue Simulation Liquids MSL1750
Type No	SL AAM 175
Manufacturer	SPEAG
-The item is composed of the following ingredients:	
H^2O	Water, 52 – 75%
C8H18O3	Diethylene glycol monobutyl ether (DGBE), 25-48%
NaCl	Sodium Chloride, <1.0%

Simulating Liquids for 5 GHz, Manufactured by SPEAG

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

10.2. Tissue Dielectric Parameter Check Results

The temperature of the tissue-equivalent medium used during measurement must also be within 18°C to 25°C and within ± 2°C of the temperature when the tissue parameters are characterized.

The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 3 – 4 days of use; or earlier if the dielectric parameters can become out of tolerance; for example, when the parameters are marginal at the beginning of the measurement series.

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 ±(%)
10/3/2012	Body 1900	e'	51.5259	Relative Permittivity (ϵ_r):	51.53	53.30	-3.33	5
		e''	14.7696	Conductivity (σ):	1.56	1.52	2.65	5
	Body 1850	e'	51.6067	Relative Permittivity (ϵ_r):	51.61	53.30	-3.18	5
		e''	14.5438	Conductivity (σ):	1.50	1.52	-1.58	5
	Body 1880	e'	51.5825	Relative Permittivity (ϵ_r):	51.58	53.30	-3.22	5
		e''	14.7500	Conductivity (σ):	1.54	1.52	1.44	5
	Body 1910	e'	51.4798	Relative Permittivity (ϵ_r):	51.48	53.30	-3.42	5
		e''	14.8009	Conductivity (σ):	1.57	1.52	3.41	5
10/8/2012	Body 1900	e'	52.0945	Relative Permittivity (ϵ_r):	52.09	53.30	-2.26	5
		e''	14.3205	Conductivity (σ):	1.51	1.52	-0.47	5
	Body 1850	e'	52.1961	Relative Permittivity (ϵ_r):	52.20	53.30	-2.07	5
		e''	14.1740	Conductivity (σ):	1.46	1.52	-4.08	5
	Body 1880	e'	52.0710	Relative Permittivity (ϵ_r):	52.07	53.30	-2.31	5
		e''	14.1237	Conductivity (σ):	1.48	1.52	-2.87	5
	Body 1910	e'	52.0302	Relative Permittivity (ϵ_r):	52.03	53.30	-2.38	5
		e''	14.4017	Conductivity (σ):	1.53	1.52	0.62	5
10/9/2012	Body 1900	e'	51.4084	Relative Permittivity (ϵ_r):	51.41	53.30	-3.55	5
		e''	14.3221	Conductivity (σ):	1.51	1.52	-0.46	5
	Body 1850	e'	51.8054	Relative Permittivity (ϵ_r):	51.81	53.30	-2.80	5
		e''	14.1758	Conductivity (σ):	1.46	1.52	-4.07	5
	Body 1880	e'	51.5450	Relative Permittivity (ϵ_r):	51.55	53.30	-3.29	5
		e''	14.2565	Conductivity (σ):	1.49	1.52	-1.95	5
	Body 1910	e'	51.4579	Relative Permittivity (ϵ_r):	51.46	53.30	-3.46	5
		e''	14.4657	Conductivity (σ):	1.54	1.52	1.07	5
10/9/2012	Body 1720	e'	53.7290	Relative Permittivity (ϵ_r):	53.73	53.52	0.39	5
		e''	14.7893	Conductivity (σ):	1.41	1.47	-3.63	5
	Body 1735	e'	53.5802	Relative Permittivity (ϵ_r):	53.58	53.48	0.19	5
		e''	14.8467	Conductivity (σ):	1.43	1.48	-3.02	5
	Body 1750	e'	53.4151	Relative Permittivity (ϵ_r):	53.42	53.44	-0.05	5
		e''	14.8781	Conductivity (σ):	1.45	1.49	-2.59	5
10/10/2012	Body 835	e'	52.7299	Relative Permittivity (ϵ_r):	52.73	55.20	-4.47	5
		e''	20.9353	Conductivity (σ):	0.97	0.97	0.21	5
	Body 820	e'	53.1594	Relative Permittivity (ϵ_r):	53.16	55.28	-3.83	5
		e''	21.2770	Conductivity (σ):	0.97	0.97	0.17	5
	Body 830	e'	52.8175	Relative Permittivity (ϵ_r):	52.82	55.24	-4.38	5
		e''	21.1051	Conductivity (σ):	0.97	0.97	0.49	5
	Body 850	e'	52.6775	Relative Permittivity (ϵ_r):	52.68	55.16	-4.50	5
		e''	21.0310	Conductivity (σ):	0.99	0.99	0.69	5
10/11/2012	Body 750	e'	53.3577	Relative Permittivity (ϵ_r):	53.36	55.55	-3.94	5
		e''	22.6678	Conductivity (σ):	0.95	0.96	-1.85	5
	Body 775	e'	53.5774	Relative Permittivity (ϵ_r):	53.58	55.45	-3.38	5
		e''	22.2624	Conductivity (σ):	0.96	0.97	-0.59	5
	Body 790	e'	53.6189	Relative Permittivity (ϵ_r):	53.62	55.39	-3.20	5
		e''	22.3234	Conductivity (σ):	0.98	0.97	1.49	5

Tissue Dielectric Parameter Check Results (continued)

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
10/12/2012	Body 1900	e'	51.9040	Relative Permittivity (ϵ_r):	51.90	53.30	-2.62	5
		e''	14.2882	Conductivity (σ):	1.51	1.52	-0.69	5
	Body 1850	e'	52.0816	Relative Permittivity (ϵ_r):	52.08	53.30	-2.29	5
		e''	14.0622	Conductivity (σ):	1.45	1.52	-4.83	5
	Body 1880	e'	52.0341	Relative Permittivity (ϵ_r):	52.03	53.30	-2.38	5
		e''	14.2493	Conductivity (σ):	1.49	1.52	-2.00	5
	Body 1910	e'	51.8934	Relative Permittivity (ϵ_r):	51.89	53.30	-2.64	5
		e''	14.2405	Conductivity (σ):	1.51	1.52	-0.50	5
10/15/2012	Body 835	e'	52.7996	Relative Permittivity (ϵ_r):	52.80	55.20	-4.35	5
		e''	20.5592	Conductivity (σ):	0.95	0.97	-1.59	5
	Body 820	e'	52.7356	Relative Permittivity (ϵ_r):	52.74	55.28	-4.60	5
		e''	20.9474	Conductivity (σ):	0.96	0.97	-1.38	5
	Body 830	e'	52.6610	Relative Permittivity (ϵ_r):	52.66	55.24	-4.67	5
		e''	20.6049	Conductivity (σ):	0.95	0.97	-1.89	5
	Body 850	e'	52.5510	Relative Permittivity (ϵ_r):	52.55	55.16	-4.72	5
		e''	20.3023	Conductivity (σ):	0.96	0.99	-2.80	5
10/16/2012	Body 835	e'	53.8900	Relative Permittivity (ϵ_r):	53.89	55.20	-2.37	5
		e''	21.1434	Conductivity (σ):	0.98	0.97	1.20	5
	Body 820	e'	53.8262	Relative Permittivity (ϵ_r):	53.83	55.28	-2.62	5
		e''	21.4759	Conductivity (σ):	0.98	0.97	1.11	5
	Body 830	e'	53.9083	Relative Permittivity (ϵ_r):	53.91	55.24	-2.41	5
		e''	21.1286	Conductivity (σ):	0.98	0.97	0.61	5
	Body 850	e'	54.0758	Relative Permittivity (ϵ_r):	54.08	55.16	-1.96	5
		e''	20.9116	Conductivity (σ):	0.99	0.99	0.12	5
10/18/2012	Body 835	e'	54.2576	Relative Permittivity (ϵ_r):	54.26	55.20	-1.71	5
		e''	20.7330	Conductivity (σ):	0.96	0.97	-0.76	5
	Body 820	e'	54.5074	Relative Permittivity (ϵ_r):	54.51	55.28	-1.39	5
		e''	21.0067	Conductivity (σ):	0.96	0.97	-1.10	5
	Body 830	e'	54.0206	Relative Permittivity (ϵ_r):	54.02	55.24	-2.20	5
		e''	21.0103	Conductivity (σ):	0.97	0.97	0.04	5
	Body 850	e'	54.1309	Relative Permittivity (ϵ_r):	54.13	55.16	-1.86	5
		e''	20.7387	Conductivity (σ):	0.98	0.99	-0.71	5
10/19/2012	Body 1900	e'	52.5099	Relative Permittivity (ϵ_r):	52.51	53.30	-1.48	5
		e''	14.6164	Conductivity (σ):	1.54	1.52	1.59	5
	Body 1850	e'	52.7018	Relative Permittivity (ϵ_r):	52.70	53.30	-1.12	5
		e''	14.3734	Conductivity (σ):	1.48	1.52	-2.73	5
	Body 1880	e'	52.6405	Relative Permittivity (ϵ_r):	52.64	53.30	-1.24	5
		e''	14.5709	Conductivity (σ):	1.52	1.52	0.21	5
	Body 1910	e'	52.4525	Relative Permittivity (ϵ_r):	52.45	53.30	-1.59	5
		e''	14.6501	Conductivity (σ):	1.56	1.52	2.36	5
10/19/2012	Body 1720	e'	53.2405	Relative Permittivity (ϵ_r):	53.24	53.52	-0.52	5
		e''	15.4974	Conductivity (σ):	1.48	1.47	0.98	5
	Body 1735	e'	53.1228	Relative Permittivity (ϵ_r):	53.12	53.48	-0.67	5
		e''	15.4840	Conductivity (σ):	1.49	1.48	1.14	5
	Body 1750	e'	53.1725	Relative Permittivity (ϵ_r):	53.17	53.44	-0.50	5
		e''	15.5109	Conductivity (σ):	1.51	1.49	1.56	5
10/19/2012	Body 750	e'	54.3072	Relative Permittivity (ϵ_r):	54.31	55.55	-2.23	5
		e''	22.4791	Conductivity (σ):	0.94	0.96	-2.66	5
	Body 775	e'	54.0329	Relative Permittivity (ϵ_r):	54.03	55.45	-2.56	5
		e''	22.3561	Conductivity (σ):	0.96	0.97	-0.17	5
	Body 790	e'	53.8727	Relative Permittivity (ϵ_r):	53.87	55.39	-2.74	5
		e''	22.3516	Conductivity (σ):	0.98	0.97	1.62	5

11. System Performance Check

SAR system verification is required to confirm measurement accuracy, according to the tissue dielectric media, probe calibration points and other system operating parameters required for measuring the SAR of a test device. The system verification must be performed for each frequency band and within the valid range of each probe calibration point required for testing the device. The same SAR probe(s) and tissue-equivalent media combinations used with each specific SAR system for system verification must be used for device testing. When multiple probe calibration points are required to cover substantially large transmission bands, independent system verifications are required for each probe calibration point. A system verification must be performed before each series of SAR measurements using the same probe calibration point and tissue-equivalent medium. Additional system verification should be considered according to the conditions of the tissue-equivalent medium and measured tissue dielectric parameters, typically every three to four days when the liquid parameters are remeasured or sooner when marginal liquid parameters are used at the beginning of a series of measurements.

11.1. System Performance Check Measurement Conditions

- The measurements were performed in the flat section of the TWIN SAM or ELI phantom, shell thickness: 2.0 ±0.2 mm (bottom plate) filled with Body or Head simulating liquid of the following parameters.
- The depth of tissue-equivalent liquid in a phantom must be ≥ 15.0 cm ± 0.5 cm for SAR measurements ≤ 3 GHz and ≥ 10.0 cm ± 0.5 cm for measurements > 3 GHz.
- The DASY system with an E-Field Probe was used for the measurements.
- The dipole was mounted on the small tripod so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10 mm (above 1 GHz) and 15 mm (below 1 GHz) from dipole center to the simulating liquid surface.
- The coarse grid with a grid spacing of 15 mm was aligned with the dipole.
  For 5 GHz band - The coarse grid with a grid spacing of 10 mm was aligned with the dipole.
- Special 7x7x7 (below 3 GHz) and/or 8x8x7 (above 3 GHz) fine cube was chosen for the cube.
- Distance between probe sensors and phantom surface was set to 3 mm.
  For 5 GHz band - Distance between probe sensors and phantom surface was set to 2.5 mm
- The dipole input power (forward power) was 100 mW.
- The results are normalized to 1 W input power.

11.2. Reference SAR Values for System Performance Check

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

System Dipole	Serial No.	Cal. Date	Freq. (MHz)	Target SAR Values (W/kg)		
				1g/10g	Head	Body
D750V3	1019	2/9/12	750	1g	8.44	8.84
				10g	5.53	5.84
D835V2	4d002	3/6/12	835	1g	9.32	9.41
				10g	6.08	6.20
D835V2	4d117	4/10/12	835	1g	9.38	9.52
				10g	6.15	6.31
D1750V2	1050	4/19/12	1750	1g	35.9	36.9
				10g	19.1	19.9
D1900V2	5d140	4/12/12	1900	1g	39.8	40.2
				10g	20.8	21.3

11.3. System Performance Check Results

The 1-g and 10-g SAR measured with a reference dipole, using the required tissue-equivalent medium at the test frequency, must be within 10% of the manufacturer calibrated dipole SAR target.

Date Tested	System Dipole		T.S. Liquid	SAR Measured (Normalized to 1		Target (Ref. Value)	Delta (%)	Tolerance (%)	Plot No.
	Type	Serial No.							
10/3/2012	D1900V2	5d140	Body	1g	41.30	40.20	2.74	±10	1,2
				10g	21.60	21.30	1.41		
10/8/2012	D1900V2	5d140	Body	1g	40.00	40.20	-0.50	±10	
				10g	21.10	21.30	-0.94		
10/9/2012	D1900V2	5d140	Body	1g	42.20	40.20	4.98	±10	
				10g	22.20	21.30	4.23		
10/9/2012	D1750V2	1050	Body	1g	36.00	36.90	-2.44	±10	
				10g	19.40	19.90	-2.51		
10/10/2012	D835V2	4d002	Body	1g	9.81	9.41	4.25	±10	3,4
				10g	6.46	6.20	4.19		
10/11/2012	D750V3	1019	Body	1g	8.74	8.84	-1.13	±10	
				10g	5.82	5.84	-0.34		
10/12/2012	D1900V2	5d140	Body	1g	39.40	40.20	-1.99	±10	
				10g	20.60	21.30	-3.29		
10/15/2012	D835V2	4d117	Body	1g	9.61	9.52	0.95	±10	
				10g	6.34	6.31	0.48		
10/16/2012	D835V2	4d117	Body	1g	9.79	9.52	2.84	±10	5,6
				10g	6.44	6.31	2.06		
10/18/2012	D835V2	4d117	Body	1g	9.68	9.52	1.68	±10	
				10g	6.38	6.31	1.11		
10/19/2012	D1900V2	5d140	Body	1g	40.50	40.20	0.75	±10	
				10g	21.00	21.30	-1.41		
10/19/2012	D1750V2	1050	Body	1g	38.60	36.90	4.61	±10	7,8
				10g	20.50	19.90	3.02		
10/19/2012	D750V3	1019	Body	1g	8.63	8.84	-2.38	±10	9,10
				10g	5.76	5.84	-1.37		

12. SAR Test Results

12.1. GSM850

Test Position	Dist. (mm)	Mode	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.	Note
					Tune-up limit	Meas.	Meas.	Scaled		
Horizontal-Up	5	GPRS 2 slots	128	824.2	32.0	30.9	1.100	**1.417**	1	
			190	836.6	32.0	31.3	1.140	1.339	2	
			251	848.8	32.0	31.4	1.110	1.274	3	
Horizontal-Down	5	GPRS 2 slots	128	824.2	32.0	30.9	0.851	1.096	4	
			190	836.6	32.0	31.3	0.877	1.030	5	
			251	848.8	32.0	31.4	0.860	0.987	6	
Vertical Front	5	GPRS 2 slots	128	824.2	32.0	30.9				1
			190	836.6	32.0	31.3	0.126	0.148	7	
			251	848.8	32.0	31.4				1
Vertical Back	5	GPRS 2 slots	128	824.2	32.0	30.9				1
			190	836.6	32.0	31.3	0.512	0.602	8	
			251	848.8	32.0	31.4				1
Bottom Tip	5	GPRS 2 slots	128	824.2	32.0	30.9				1
			190	836.6	32.0	31.3	0.475	0.558	9	
			251	848.8	32.0	31.4				1

Note(s):

1. According to KDB 447498, Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz.

12.2. GSM1900

Test Position	Dist. (mm)	Mode	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.	Note
					Tune-up limit	Meas.	Meas.	Scaled		
Horizontal-Up	5	GPRS 2 slots	512	1850.2	30.0	29.3	1.140	1.330	1	
			661	1880.0	30.0	29.6	1.160	1.287	2	
			810	1909.8	30.0	29.5	1.270	**1.415**	3	
Horizontal-Down	5	GPRS 2 slots	512	1850.2	30.0	29.3	0.802	0.936	4	
			661	1880.0	30.0	29.6	0.852	0.945	5	
			810	1909.8	30.0	29.5	0.902	1.005	6	
Vertical Front	5	GPRS 2 slots	512	1850.2	30.0	29.3				1
			661	1880.0	30.0	29.6	0.123	0.136	7	
			810	1909.8	30.0	29.5				1
Vertical Back	5	GPRS 2 slots	512	1850.2	30.0	29.3	0.835	0.974	8	
			661	1880.0	30.0	29.6	0.870	0.965	9	
			810	1909.8	30.0	29.5	0.914	1.018	10	
Bottom Tip	5	GPRS 2 slots	512	1850.2	30.0	29.3				1
			661	1880.0	30.0	29.6	0.425	0.471	11	
			810	1909.8	30.0	29.5				1

Note(s):

1. According to KDB 447498, Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz.

12.3. WCDMA (UMTS) Band V

Test mode reduction considerations

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

Test Position	Dist. (mm)	Mode	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.	Note
					Tune-up limit	Meas.	Meas.	Scaled		
Horizontal-Up	5	Rel99 RMC 12.2Kbps	4132	826.4	24.0	23.4	0.851	0.982	1	
			4183	836.6	24.0	23.4	0.885	**1.014**	**2**	
			4233	846.6	24.0	23.5	0.865	0.968	3	
Horizontal-Down	5	Rel99 RMC 12.2Kbps	4132	826.4	24.0	23.4				1
			4183	836.6	24.0	23.4	0.586	0.671	4	
			4233	846.6	24.0	23.5				1
Vertical Front	5	Rel99 RMC 12.2Kbps	4132	826.4	24.0	23.4				1
			4183	836.6	24.0	23.4	0.072	0.082	5	
			4233	846.6	24.0	23.5				1
Vertical Back	5	Rel99 RMC 12.2Kbps	4132	826.4	24.0	23.4				1
			4183	836.6	24.0	23.4	0.338	0.387	6	
			4233	846.6	24.0	23.5				1
Bottom Tip	5	Rel99 RMC 12.2Kbps	4132	826.4	24.0	23.4				1
			4183	836.6	24.0	23.4	0.300	0.344	7	
			4233	846.6	24.0	23.5				1

Note(s):

1. According to KDB 447498, Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz.

12.4. WCDMA (UMTS) Band II

Test mode reduction considerations

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

Test Position	Dist. (mm)	Mode	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.	Note
					Tune-up limit	Meas.	Meas.	Scaled		
Horizontal-Up	5	Rel99 RMC 12.2Kbps	9262	1852.4	23.0	22.5	1.070	1.203	1	
			9400	1880.0	23.0	22.4	1.150	1.320	2	
			9538	1907.6	23.0	22.5	1.100	1.226	3	
		HSPA	9400	1880.0	23.0	21.0	0.896	**1.407**	**4**	2
Horizontal-Down	5	Rel99 RMC 12.2Kbps	9262	1852.4	23.0	22.5	0.731	0.822	5	
			9400	1880.0	23.0	22.4	0.852	0.978	6	
			9538	1907.6	23.0	22.5	0.868	0.967	7	
Vertical Front	5	Rel99 RMC 12.2Kbps	9262	1852.4	23.0	22.5				1
			9400	1880.0	23.0	22.4	0.117	0.134	8	
			9538	1907.6	23.0	22.5				1
Vertical Back	5	Rel99 RMC 12.2Kbps	9262	1852.4	23.0	22.5				1
			9400	1880.0	23.0	22.4	0.693	0.796	9	
			9538	1907.6	23.0	22.5				1
Bottom Tip	5	Rel99 RMC 12.2Kbps	9262	1852.4	23.0	22.5				1
			9400	1880.0	23.0	22.4	0.441	0.506	10	
			9538	1907.6	23.0	22.5				1

Note(s):

1. According to KDB 447498, Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz.
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.

12.5. LTE Band 2 (10 MHz Bandwidth)

Test Position	Dist. (mm)	Mode	UL Ch #.	Freq. (MHz)	UL RB Allocation	UL RB Offset	Power (dBm)		1-g SAR (W/kg)		Plot No.	Note
							Tune-up Limit	Meas.	Meas.	Scaled		
Horizontal-Up	5	QPSK	18650	1855.0	1	0	23.0	22.9	1.130	1.170	1	
					25	0	22.0	21.9	0.907	0.930	2	
			18900	1880.0	1	0	23.0	23.0	1.110	1.110	3	
					25	0	22.0	21.9	0.874	0.894	4	
					50	0	22.0	21.8	0.846	0.892	5	
			19150	1905.0	1	49	23.0	23.0	1.210	**1.210**	6	
					25	0	22.0	21.9	0.906	0.938	7	
Horizontal-Down	5	QPSK	18650	1855.0	1	0	23.0	22.9	0.865	0.895	8	
			18900	1880.0	1	0	23.0	23.0	0.887	0.887	9	
					25	0	22.0	21.9	0.699	0.715	10	
					50	0	22.0	21.8	0.684	0.721	11	
			19150	1905.0	1	49	23.0	23.0	0.945	0.945	12	
Vertical Front	5	QPSK	18900	1880.0	1	0	23.0	23.0	0.226	0.226	13	
					25	0	22.0	21.9	0.175	0.179	14	
Vertical Back	5	QPSK	18650	1855.0	1	0	23.0	22.9	0.850	0.880	15	
			18900	1880.0	1	0	23.0	23.0	0.884	0.884	16	
					25	0	22.0	21.9	0.662	0.677	17	
					50	0	22.0	21.8	0.650	0.685	18	
			19150	1905.0	1	49	23.0	23.0	0.924	0.924	19	
Bottom Tip	5	QPSK	18900	1880.0	1	0	23.0	23.0	0.450	0.450	20	
					25	0	22.0	21.9	0.337	0.345	21	

Note(s):

Per KDB 941225 D05 SAR for LTE Devices v02, SAR test reduction is applied using the following criteria:

- Testing for Low and High Channel is performed at the highest output power level for 1RB, and 50% RB configuration for that channel.
- Testing for 100% RB configuration is performed at the highest output power level for 100% RB configuration across the Low, Mid and High Channel when the highest reported SAR for 1 RB and 50% RB are $\geq$ 0.8 W/kg. Testing for the remaining required channels is not needed because the reported SAR for 100% RB Allocation < 1.45 W/kg.
- Testing for 16-QAM modulation is not required because the reported SAR for QPSK is < 1.45 W/Kg and its output power is not more than 0.5 dB higher than that of QPSK.
- Testing for the other channel bandwidths is not required because the reported SAR for the highest channel bandwidth is < 1.45 W/Kg and its output power is not more than 0.5 dB higher than that of the highest channel bandwidth.

12.6. LTE Band 4 (10 MHz Bandwidth)

Test Position	Dist. (mm)	Mode	UL Ch #.	Freq. (MHz)	UL RB Allocation	UL RB Offset	Power (dBm)		1-g SAR (W/kg)		Plot No.	Note
							Tune-up Limit	Meas.	Meas.	Scaled		
Horizontal-Up	5	QPSK	20000	1715.0	1	24	23.0	22.4	0.790	0.905	1	
			20175	1732.5	1	49	23.0	22.6	0.875	**0.962**	2	
					25	12	22.0	21.4	0.594	0.677	3	
					50	0	22.0	21.3	0.581	0.679	4	
			20350	1750.0	1	0	23.0	22.6	0.853	0.946	5	
Horizontal-Down	5	QPSK	20175	1732.5	1	49	23.0	22.6	0.445	0.489	6	
					25	12	22.0	21.4	0.330	0.376	7	
Vertical Front	5	QPSK	20175	1732.5	1	49	23.0	22.6	0.185	0.203	8	
					25	12	22.0	21.4	0.133	0.152	9	
Vertical Back	5	QPSK	20175	1732.5	1	49	23.0	22.6	0.418	0.459	10	
					25	12	22.0	21.4	0.299	0.341	11	
Bottom Tip	5	QPSK	20175	1732.5	1	49	23.0	22.6	0.401	0.441	12	
					25	12	22.0	21.4	0.296	0.338	13	

Note(s):

Per KDB 941225 D05 SAR for LTE Devices v02, SAR test reduction is applied using the following criteria:

- Testing for Low and High Channel is performed at the highest output power level for 1RB, and 50% RB configuration for that channel.
- Testing for 100% RB configuration is performed at the highest output power level for 100% RB configuration across the Low, Mid and High Channel when the highest reported SAR for 1 RB and 50% RB are $\geq$ 0.8 W/kg. Testing for the remaining required channels is not needed because the reported SAR for 100% RB Allocation < 1.45 W/kg.
- Testing for 16-QAM modulation is not required because the reported SAR for QPSK is < 1.45 W/Kg and its output power is not more than 0.5 dB higher than that of QPSK.
- Testing for the other channel bandwidths is not required because the reported SAR for the highest channel bandwidth is < 1.45 W/Kg and its output power is not more than 0.5 dB higher than that of the highest channel bandwidth.

12.7. LTE Band 5 (10 MHz Bandwidth)

Test Position	Dist. (mm)	Mode	UL Ch #.	Freq. (MHz)	UL RB Allocation	UL RB Offset	Power (dBm)		1-g SAR (W/kg)		Plot No.	Note
							Tune-up Limit	Meas.	Meas.	Scaled		
Horizontal-Up	5	QPSK	20450	829.0	1	0	24.0	23.1	0.874	**1.080**	1	
					25	0	23.0	22.1	0.687	0.843	2	
			20525	836.5	1	24	24.0	23.2	0.843	1.014	3	
					25	24	23.0	22.1	0.678	0.838	4	
					50	0	23.0	22.1	0.655	0.815	5	
			20600	844.0	1	0	24.0	23.1	0.847	1.044	6	
					25	12	23.0	22.0	0.649	0.823	7	
Horizontal-Down	5	QPSK	20525	836.5	1	24	24.0	23.2	0.636	0.765	8	
					25	24	23.0	22.1	0.500	0.618	9	
Vertical Front	5	QPSK	20525	836.5	1	24	24.0	23.2	0.037	0.045	10	
					25	24	23.0	22.1	0.028	0.035	11	
Vertical Back	5	QPSK	20525	836.5	1	24	24.0	23.2	0.336	0.404	12	
					25	24	23.0	22.1	0.266	0.329	13	
Bottom Tip	5	QPSK	20525	836.5	1	24	24.0	23.2	0.322	0.387	14	
					25	24	23.0	22.1	0.234	0.289	15	

Note(s):

Per KDB 941225 D05 SAR for LTE Devices v02, SAR test reduction is applied using the following criteria:

- Testing for Low and High Channel is performed at the highest output power level for 1RB, and 50% RB configuration for that channel.
- Testing for 100% RB configuration is performed at the highest output power level for 100% RB configuration across the Low, Mid and High Channel when the highest reported SAR for 1 RB and 50% RB are $\geq$ 0.8 W/kg. Testing for the remaining required channels is not needed because the reported SAR for 100% RB Allocation < 1.45 W/kg.
- Testing for 16-QAM modulation is not required because the reported SAR for QPSK is < 1.45 W/Kg and its output power is not more than 0.5 dB higher than that of QPSK.
- Testing for the other channel bandwidths is not required because the reported SAR for the highest channel bandwidth is < 1.45 W/Kg and its output power is not more than 0.5 dB higher than that of the highest channel bandwidth.

12.8. LTE Band 17 (10 MHz Bandwidth)

Test Position	Dist. (mm)	Mode	UL Ch #.	Freq. (MHz)	UL RB Allocation	UL RB Offset	Power (dBm)		1-g SAR (W/kg)		Plot No.	Note
							Tune-up Limit	Meas.	Meas.	Scaled		
Horizontal-Up	5	QPSK	23780	709.0	1	24	24.0	23.0	0.757	0.953	1	
			23790	710.0	1	24	24.0	22.7	0.741	**1.009**	2	
			23800	711.0	1	24	24.0	23.2	0.761	0.911	3	
					25	12	23.0	22.1	0.592	0.723	4	
					50	0	23.0	21.9	0.586	0.751	5	
Horizontal-Down	5	QPSK	23800	711.0	1	24	24.0	23.2	0.650	0.778	6	
					25	12	23.0	22.1	0.519	0.634	7	
Vertical Front	5	QPSK	23800	711.0	1	24	24.0	23.2	0.117	0.140	8	
					25	12	23.0	22.1	0.089	0.109	9	
Vertical Back	5	QPSK	23800	711.0	1	24	24.0	23.2	0.461	0.552	10	
					25	12	23.0	22.1	0.354	0.433	11	
Bottom Tip	5	QPSK	23800	711.0	1	24	24.0	23.2	0.230	0.275	12	
					25	12	23.0	22.1	0.190	0.232	13	

Note(s):

Per KDB 941225 D05 SAR for LTE Devices v02, SAR test reduction is applied using the following criteria:

- Testing for Low and High Channel is performed at the highest output power level for 1RB, and 50% RB configuration for that channel.
- Testing for 100% RB configuration is performed at the highest output power level for 100% RB configuration across the Low, Mid and High Channel when the highest reported SAR for 1 RB and 50% RB are $\geq$ 0.8 W/kg. Testing for the remaining required channels is not needed because the reported SAR for 100% RB Allocation < 1.45 W/kg.
- Testing for 16-QAM modulation is not required because the reported SAR for QPSK is < 1.45 W/Kg and its output power is not more than 0.5 dB higher than that of QPSK.
- Testing for the other channel bandwidths is not required because the reported SAR for the highest channel bandwidth is < 1.45 W/Kg and its output power is not more than 0.5 dB higher than that of the highest channel bandwidth.

13. Summary of Highest Measured SAR Values

Results of highest SAR values for each frequency band and mode

Technology/Band	Test Configuration	Mode	Dist. (mm)	Ch #.	Freq. (MHz)	Power (dBm)	1-g SAR (W/kg)
GSM850	Horizontal-Up	GPRS 2 Slots	5	190	836.6	31.3	1.140
GSM1900	Horizontal-Up	GPRS 2 Slots	5	810	1909.8	29.5	1.270
W-CDMA Band V	Horizontal-Up	Rel. 99 RMC 12.2 kbps	5	4183	836.6	23.4	0.885
W-CDMA Band II	Horizontal-Up	Rel. 99 RMC 12.2 kbps	5	9400	1880.0	22.4	1.150
LTE Band 2	Horizontal-Up	10 MHz (QPSK) RB 1/49	5	19150	1905.0	23.0	1.210
LTE Band 4	Horizontal-Up	10 MHz (QPSK) RB 1/49	5	20175	1732.5	22.6	0.875
LTE Band 5	Horizontal-Up	10 MHz (QPSK) RB 1/0	5	20450	829.0	23.1	0.874
LTE Band 17	Horizontal-Up	10 MHz (QPSK) RB 1/24	5	23800	711.0	23.2	0.761

13.1. SAR Measurement Variability and Uncertainty

In accordance with published RF Exposure KDB procedure 865664 D01 SAR measurement 100 MHz to 6 GHz v01. These additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

1) Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg; steps 2) through 4) do not apply.
2) When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.
3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).
4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

Wireless Technologies	Test Configuration	Mode	Ch #.	Freq. (MHz)	Meas. SAR (W/kg)		Largest to Smallest SAR Ratio	Plot No.	Note
					Original	Repeated			
GSM850	Horizontal-Up	GPRS 2 Slots	190	836.6	1.140	1.110	1.03	1	
GSM1900	Horizontal-Up	GPRS 2 Slots	810	1909.8	1.270	1.250	1.02	2	
LTE Band 4	Horizontal-Up	10 MHz (QPSK) RB 1/49	20175	1732.5	0.875	0.877	1.00	3	
LTE Band 17	Horizontal-Up	10 MHz (QPSK) RB 1/24	23800	711.0	0.761	N/A	N/A	N/A	2

Note(s):
1. Second Repeated Measurement is not required since the ratio of the largest to smallest SAR for the original and first repeated measurement is not > 1.20.
2. Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg.

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

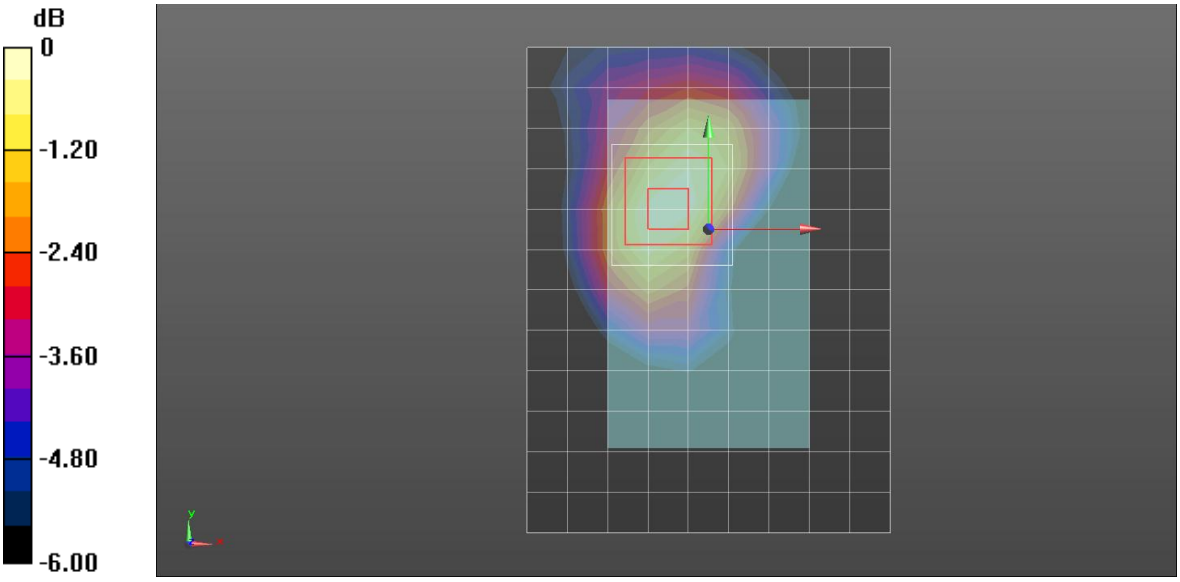
Test Laboratory: UL CCS SAR Lab E Date: 10/16/2012

GSM850

Frequency: 836.6 MHz; Duty Cycle: 1:4; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.982 mho/m; ε_r = 53.938; 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 Sn1343; Calibrated: 8/20/2012
- Probe: EX3DV4 - SN3871; ConvF(9.68, 9.68, 9.68); Calibrated: 8/20/2012;
- 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: QDOVA002AA; Serial: 1180

Horizontal-Up/GPRS 2 slots/Ch 190/Area Scan (10x13x1): Measurement grid: dx=10mm, dy=10mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.33 W/kg

Horizontal-Up/GPRS 2 slots/Ch 190/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 39.441 V/m; Power Drift = -0.132 dB
Peak SAR (extrapolated) = 1.699 mW/g
SAR(1 g) = 1.14 mW/g; SAR(10 g) = 0.735 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.39 W/kg



0 dB = 1.39 W/kg = 2.86 dB W/kg

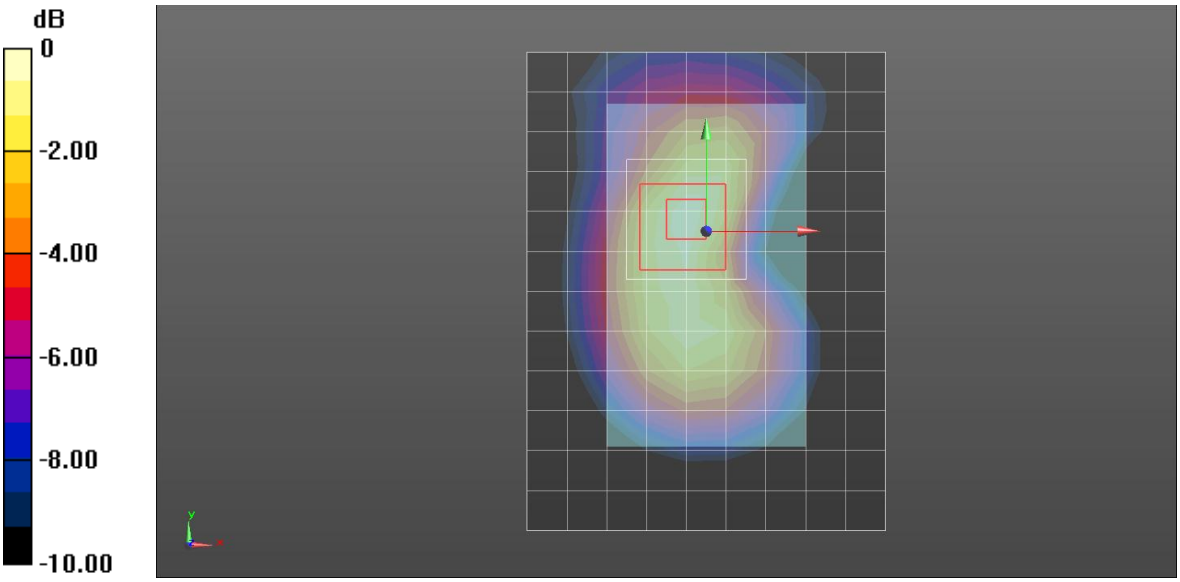
Test Laboratory: UL CCS SAR Lab E Date: 10/9/2012

GSM1900

Frequency: 1909.8 MHz; Duty Cycle: 1:4; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C
Medium parameters used: f = 1910 MHz; σ = 1.537 mho/m; ε_r = 51.458; 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 Sn1343; Calibrated: 8/20/2012
- Probe: EX3DV4 - SN3871; ConvF(7.83, 7.83, 7.83); Calibrated: 8/20/2012;
- 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: QDOVA002AA; Serial: TP:xxxx

Horizontal-Up/GPRS 2 slots/Ch 810/Area Scan (10x13x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 1.62 W/kg

Horizontal-Up/GPRS 2 slots/Ch 810/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 32.885 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 2.068 mW/g
SAR(1 g) = 1.27 mW/g; SAR(10 g) = 0.716 mW/g
Maximum value of SAR (measured) = 1.63 W/kg



0 dB = 1.63 W/kg = 4.24 dB W/kg

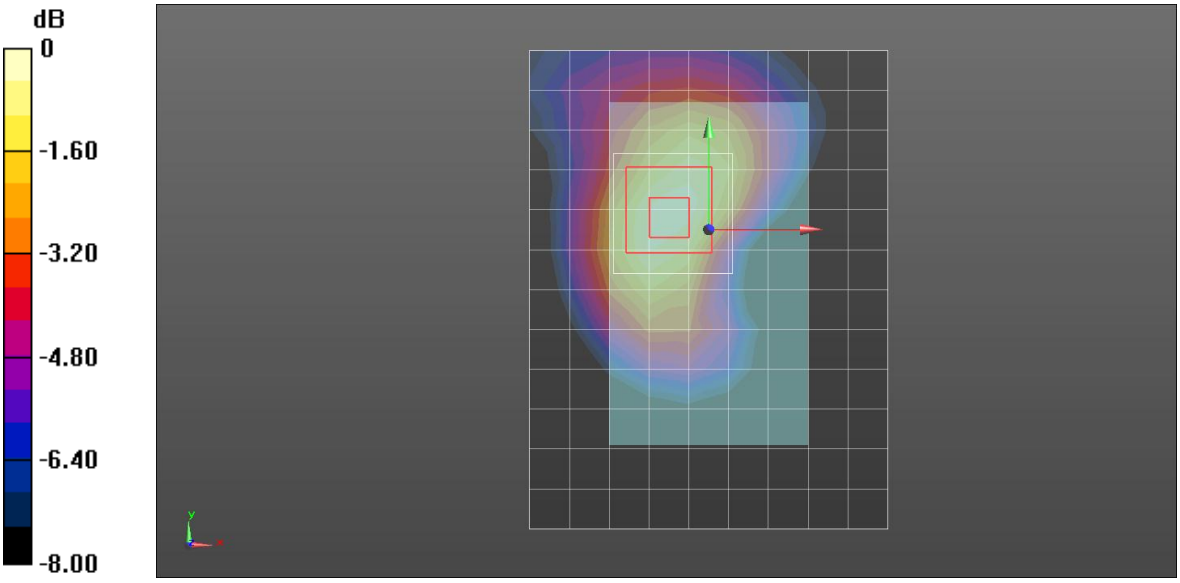
Test Laboratory: UL CCS SAR Lab E Date: 10/10/2012

WCDMA 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 = 0.975 mho/m; ε_r = 52.73; 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 Sn1343; Calibrated: 8/20/2012
- Probe: EX3DV4 - SN3871; ConvF(9.68, 9.68, 9.68); Calibrated: 8/20/2012;
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: ELI v5.0 A; Type: QDOVA002AA; Serial: 1180

Horizontal-Up/Rel.99/CH4183/Area Scan (10x13x1): Measurement grid: dx=10mm, dy=10mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.03 W/kg

Horizontal-Up/Rel.99/CH4183/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 34.039 V/m; Power Drift = -0.12 dB
Peak SAR (extrapolated) = 1.343 mW/g
SAR(1 g) = 0.885 mW/g; SAR(10 g) = 0.560 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.09 W/kg



0 dB = 1.09 W/kg = 0.75 dB W/kg

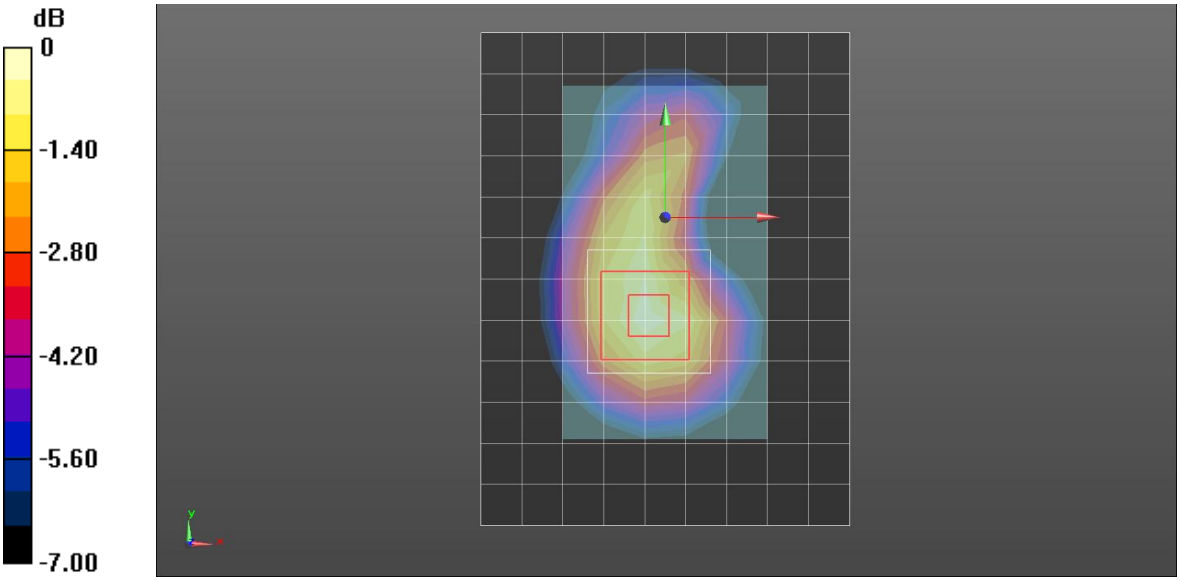
Test Laboratory: UL CCS SAR Lab E Date: 10/3/2012

WCDMA Band II

Frequency: 1880 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C
Medium parameters used: f = 1880 MHz; σ = 1.543 mho/m; ε_r = 51.583; 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 Sn1343; Calibrated: 8/20/2012
- Probe: EX3DV4 - SN3871; ConvF(7.83, 7.83, 7.83); Calibrated: 8/20/2012;
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: ELI v5.0 B; Type: QDOVA002AA; Serial: TP:xxxx

Horizontal-Up/Rel.99/CH9400/Area Scan (10x13x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 1.41 W/kg

Horizontal-Up/Rel.99/CH9400/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 30.317 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 1.811 mW/g
SAR(1 g) = 1.15 mW/g; SAR(10 g) = 0.686 mW/g
Maximum value of SAR (measured) = 1.44 W/kg



0 dB = 1.44 W/kg = 3.17 dB W/kg

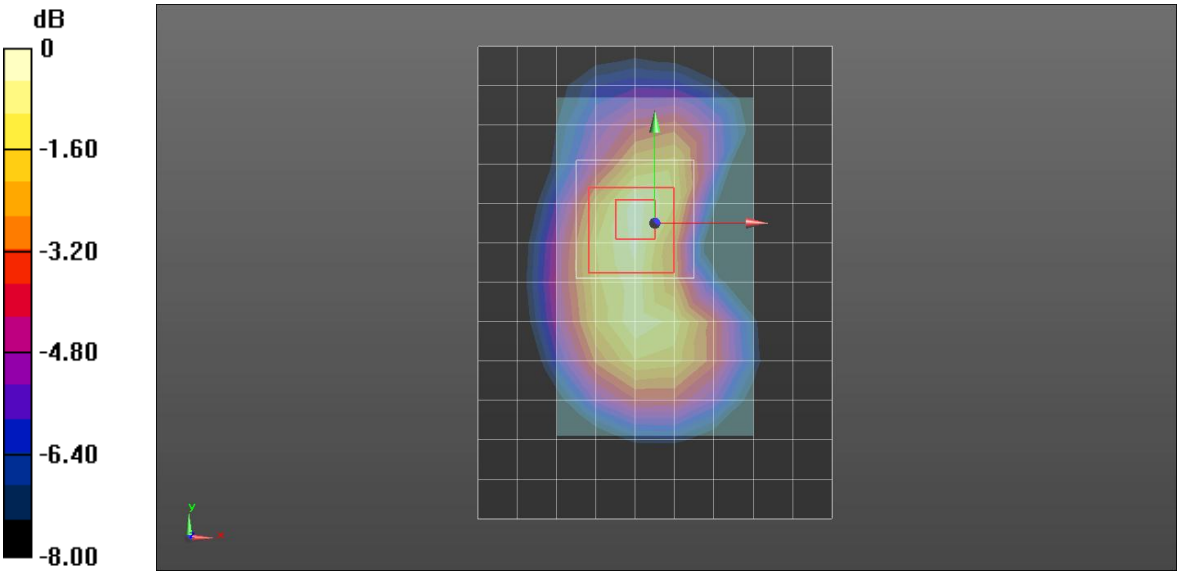
Test Laboratory: UL CCS SAR Lab E Date: 10/8/2012

LTE Band 2

Frequency: 1905 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C
Medium parameters used: f = 1905 MHz; σ = 1.518 mho/m; ε_r = 52.001; 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 Sn1343; Calibrated: 8/20/2012
- Probe: EX3DV4 - SN3871; ConvF(7.83, 7.83, 7.83); Calibrated: 8/20/2012;
- 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: 1163

Horizontal-Up/QPSK_RB# 1, 49/Ch 19150/Area Scan (10x13x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 1.49 W/kg

Horizontal-Up/QPSK_RB# 1, 49/Ch 19150/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 32.305 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 2.001 mW/g
SAR(1 g) = 1.21 mW/g; SAR(10 g) = 0.686 mW/g
Maximum value of SAR (measured) = 1.57 W/kg



0 dB = 1.57 W/kg = 3.92 dB W/kg

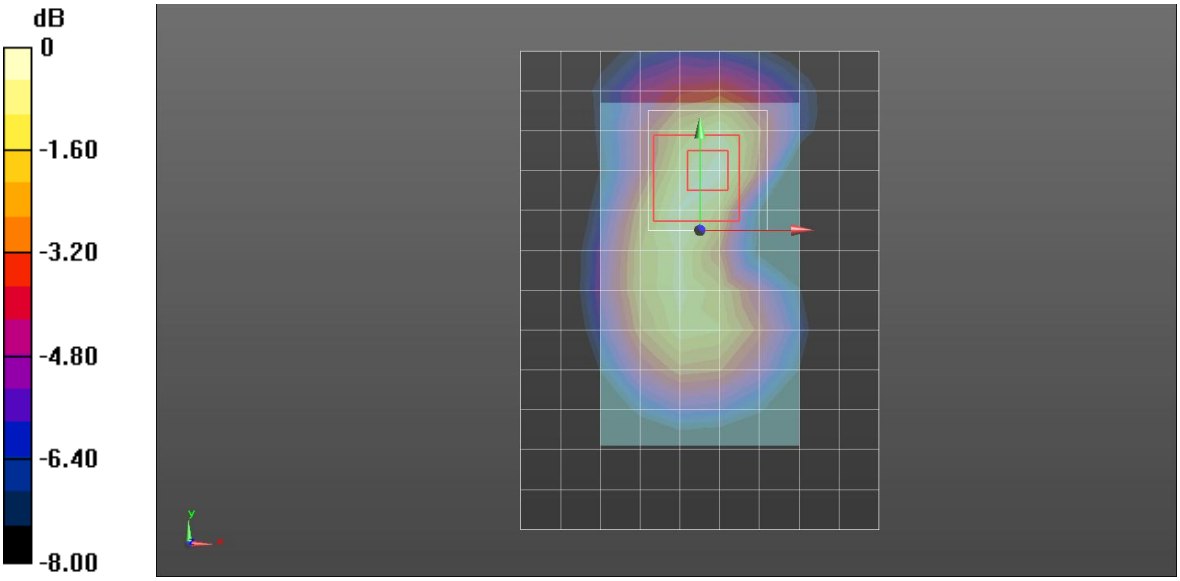
Test Laboratory: UL CCS SAR Lab E Date: 10/9/2012

LTE Band 4

Frequency: 1732.5 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C
Medium parameters used (interpolated): f = 1732.5 MHz; σ = 1.426 mho/m; ε_r = 53.663; 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 Sn1343; Calibrated: 8/20/2012
- Probe: EX3DV4 - SN3871; ConvF(8.1, 8.1, 8.1); Calibrated: 8/20/2012;
- 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: QDOVA002AA; Serial: 1180

Horizontal-Up/QPSK_RB# 1, 49/Ch 20175/Area Scan (10x13x1): Measurement grid: dx=10mm, dy=10mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.11 W/kg

Horizontal-Up/QPSK_RB# 1, 49/Ch 20175/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 28.568 V/m; Power Drift = -0.11 dB
Peak SAR (extrapolated) = 1.472 mW/g
SAR(1 g) = 0.875 mW/g; SAR(10 g) = 0.512 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.15 W/kg



0 dB = 1.15 W/kg = 1.21 dB W/kg

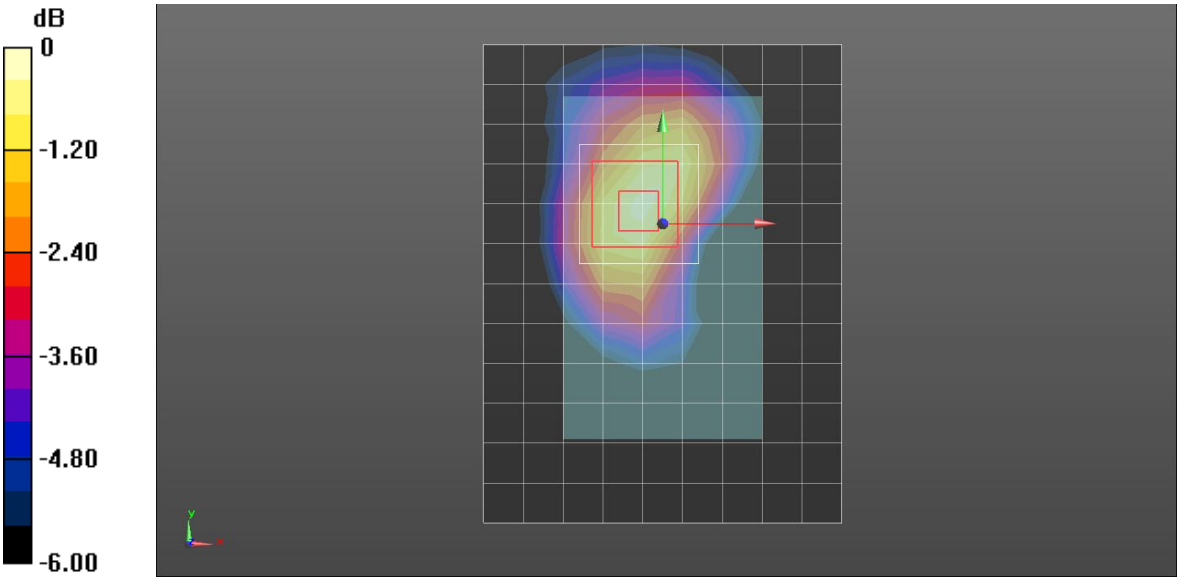
Test Laboratory: UL CCS SAR Lab E Date: 10/10/2012

LTE Band 5

Frequency: 829 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C
Medium parameters used (interpolated): f = 829 MHz; σ = 0.973 mho/m; ε_r = 52.884; 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 Sn1343; Calibrated: 8/20/2012
- Probe: EX3DV4 - SN3871; ConvF(9.68, 9.68, 9.68); Calibrated: 8/20/2012;
- 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: QDOVA002AA; Serial: 1180

Horizontal Up/QPSK_RB# 1, 0/Ch 20450/Area Scan (10x13x1): Measurement grid: dx=10mm, dy=10mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.03 W/kg

Horizontal Up/QPSK_RB# 1, 0/Ch 20450/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 32.733 V/m; Power Drift = 0.14 dB
Peak SAR (extrapolated) = 1.289 mW/g
SAR(1 g) = 0.874 mW/g; SAR(10 g) = 0.566 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.06 W/kg



0 dB = 1.06 W/kg = 0.51 dB W/kg

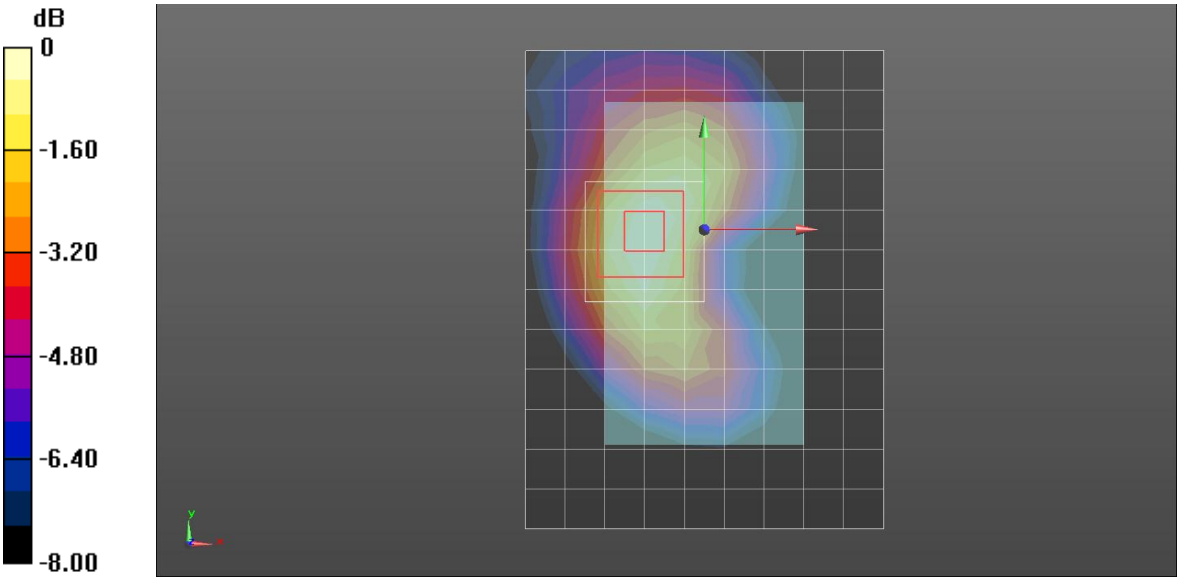
Test Laboratory: UL CCS SAR Lab E Date: 10/11/2012

LTE Band 17

Frequency: 711 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C
Medium parameters used (interpolated): f = 711 MHz; σ = 0.911 mho/m; ε_r = 54.066; 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 Sn1343; Calibrated: 8/20/2012
- Probe: EX3DV4 - SN3871; ConvF(9.75, 9.75, 9.75); Calibrated: 8/20/2012;
- 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: QDOVA002AA; Serial: 1180

Horizontal Up/QPSK_RB# 1, 24/Ch 23800/Area Scan (10x13x1): Measurement grid: dx=10mm, dy=10mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.951 W/kg

Horizontal Up/QPSK_RB# 1, 24/Ch 23800/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 32.129 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 1.106 mW/g
SAR(1 g) = 0.761 mW/g; SAR(10 g) = 0.497 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.914 W/kg



0 dB = 0.914 W/kg = -0.78 dB W/kg

14. Appendixes

Refer to separated files for the following appendixes.

14.1. System Performance Check Plots

14.2. SAR Test Plots for GSM850

14.3. SAR Test Plots for GSM1900

14.4. SAR Test Plots for W-CDMA (UMTS) Band V

14.5. SAR Test Plots for W-CDMA (UMTS) Band II

14.6. SAR Test Plots for LTE Band 2

14.7. SAR Test Plots for LTE Band 4

14.8. SAR Test Plots for LTE Band 5

14.9. SAR Test Plots for LTE Band 17

14.10. SAR Test Plots for Repeated Test

14.11. Calibration Certificate for E-Field Probe EX3DV4 - SN 3871

14.12. Calibration Certificate for D750V3 - SN 1019

14.13. Calibration Certificate for D835V2 - SN 4d002

14.14. Calibration Certificate for D835V2 - SN 4d117

14.15. Calibration Certificate for D1750V2 - SN 1050

14.16. Calibration Certificate for D1900V2 - SN 5d140