FCC OET BULLETIN 65 SUPPLEMENT C 01-01
IEEE 1528:2003
RSS-102 Issue 4, March 2010

SAR EVALUATION REPORT
(Class II Permissive Change: Added 15 & 20MHz BW for LTE band 4)

For
Apple iPad

MODEL: A1430
FCC ID: BCGA1430
IC: 579C-A1430

REPORT NUMBER: 12U14315-2
ISSUE DATE: March 2, 2012

Prepared for
APPLE INC.
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	March 2, 2012	Initial Issue based on original SAR report 11U14054-4B to include 15 MHz and 20 MHz bandwidth for LTE band 4	--

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1. Attestation of Test Results

Applicant	Apple Inc.
EUT description	The Apple iPad, Model A1430 is a tablet device with iPod functions (music, application support, and video), 802.11a/b/g/n radio, Bluetooth radio functions, and cellular using the GSM 2G/3G/LTE data radio functions.
Model number	A1430
Device category	Portable
Test device is	An identical prototype
Exposure category	General Population/Uncontrolled Exposure
Date tested	February 24 - 28, 2012

FCC Rule Parts	Freq. Range [MHz]	Highest 1-g SAR (W/kg)	Limit (W/kg)
27 (LTE Band 4)	1715 - 1750	1.16 W/kg (Body_Top edge/Rear cornerat 41° w/ 0 mm distance)	1.6

Applicable Standards	Test Results
FCC OET Bulletin 65 Supplement C 01-01, IEEE 1528:2003, RSS-102 Issue 4, March 2010	Pass

Compliance Certification Services, Inc. (UL CCS) tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL CCS based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL CCS will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government (NIST Handbook 150, Annex A). This report is written to support regulatory compliance of the applicable standards stated above.

Approved & Released For UL CCS By:

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

Tested By:

David Rodgers
SAR Engineer
Compliance Certification Services (UL CCS)

2. Test Methodology

The tests documented in this report were performed in accordance with FCC OET Bulletin 65 Supplement C 01-01, IEEE 1528:2003, RSS-102 Issue 4, March 2010 and the following KDB Test Procedures.

- 447498 D01 Mobile Portable RF Exposure v04
- 941225 D05 SAR for LTE Devices v01
- 941225 D06 Hot Spot SAR v01
- Power Reduction by Sensing (April/October 2011 TCB Workshop SAR Updates)

Testing is performed per FCC's guidance KDB # 716718.

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

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due date		
				MM	DD	Year
Dielectronic Probe kit	HP	85070C	N/A	N/A		
Base Station Simulator	R & S	CMU 200	106291	6	24	2012
ESA Series Network Analyzer	Agilent	E5071B	MY42100131	2	11	2013
Synthesized Signal Generator	HP	83732B	US34490599	7	14	2012
E-Field Probe	SPEAG	EX3DV4	3772	5	3	2012
E-Field Probe	SPEAG	EX3DV4	3749	1	27	2013
Thermometer	ERTCO	639-1S	1718	7	19	2012
Data Acquisition Electronics	SPEAG	DAE4	1239	11	18	2012
Data Acquisition Electronics	SPEAG	DAE3	427	1	17	2013
System Validation Dipole	SPEAG	D1750V2	1053	5	27	2012
System Validation Dipole	SPEAG	D1750V2	1050	4	19	2012
Power Meter	HP	437B	3125U16345	5	13	2012
Power Sensor	HP	8481A	2702A60780	5	13	2012
Amplifier	MITEQ	4D00400600-50-30P	1620606	N/A		

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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	**-2.55**	Normal	1	0.64	-1.63
Liquid Permittivity - deviation from target	5.00	Rectangular	1.732	0.6	1.73
Liquid Permittivity - measurement uncertainty	**-4.24**	Normal	1	0.6	-2.54
Combined Standard Uncertainty Uc(y) =					10.20
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =				20.40	%
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =				1.61	dB

5. Equipment Under Test

The Apple iPad, Model A1430 is a tablet device with iPod functions (music, application support, and video), 802.11a/b/g/n radio, Bluetooth radio functions, and cellular using the GSM 2G/3G/LTE data radio functions.

Model: A1430

Normal operation:	Body and Wireless Router (Hotspot)
Proximity Sensor for Power Reduction:	There is no proximity sensor for power reduction for WiFi/BT Antenna. The proximity sensor for power reduction is applied to Primary Cellular Antenna only. Trigger Distance: o 0-11 mm from Rear, o 0-14 mm from Top-edge of device.
Simultaneous Transmission:	• WWAN Radio (GPRS/EGPRS/UMTS/LTE) can transmit simultaneously with WiFi/BT Radio. • WiFi 2.4GHz Radio cannot transmit simultaneously with Bluetooth Radio. • WiFi 5GHz Radio can transmit simultaneously with Bluetooth Radio. Due to Bluetooth's maximum output is < 60/f(GHz) mW and standalone SAR is not required, Bluetooth is not considered as co-located transmitters with other radio. Bluetooth's max. output power: 15.49 mW.

5.1. KDB 941225 D05 SAR for LTE Devices v01

<table>
<tr><th>Item</th><th>Description</th><th>Information</th></tr>
<tr><td>1</td><td>Identify the operating frequency range of each LTE transmission band used by the device</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>5MHz, and 10MHz
Additional channel Bandwidths Added: 15MHz, and 20MHz.</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>
<table>
<tr><th rowspan="3">Band 4</th><th colspan="2">Channel Bandwidth</th></tr>
<tr><th>20 MHz</th><th>15 MHz</th></tr>
<tr><th>Ch. # / Freq. (MHz)</th><th>Ch. # / Freq. (MHz)</th></tr>
<tr><td>Low</td><td>20050/1720</td><td>20025/1717.5</td></tr>
<tr><td>Mid</td><td>20175/1732.5</td><td>20175/1732.5</td></tr>
<tr><td>High</td><td>20300/1745</td><td>20325/1747.5</td></tr>
</table>
</td></tr>
<tr><td>4</td><td>Specify the UE category and uplink modulations used</td><td>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>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>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>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.
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>

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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 RF output power table</td></tr>
<tr><td rowspan="17">9</td><td rowspan="17">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>US 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>GPRS/EGPRS</td><td>GMSK, 8PSK</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 4.0 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 colspan="2"></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">See section 13 RF output power measurements in SAR report.</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 WiFi/BT Radio.
• WiFi 2.4GHz Radio cannot transmit simultaneously with Bluetooth Radio.
• WiFi 5GHz Radio can transmit simultaneously with Bluetooth Radio.</td></tr>
</table>

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

5.2. Personal Hotspot Mode

The device is capable of personal hotspot mode. The hotspot mode can be enabled by the users by the following this sequence of soft-keys; Settings > General > Network > Enable Personal Hotspot.

WiFi Hotspot mode permits the device to share its cellular data connection with other 2.4 GHz WiFi-enabled devices (channels 1 - 11). WiFi Hotspot mode is not supported in 5.0 GHz WiFi band.

As the tablet has a diagonal size of greater than 20 cm, and in accordance with FCC training provided in October 2011 (TCBC Workshop) hot spot SAR is not required for this device.

5.3. Description of Antennas

The device has two cellular antennas located on the top-edge of the device. The Primary Cellular Antenna is located on the top-edge of the device on the right side of the front camera and to the left side of the power button. The Secondary Cellular Antenna is located on the top-edge of the device, on the left side of the front camera.

The Primary Antenna is, by design, capable of cellular transmission and reception, and the Secondary Antenna is only capable of cellular reception only. WiFi 2.4GHz cannot transmit simultaneously with Bluetooth. WiFi 5.0GHz can transmit simultaneously with Bluetooth.

Antenna	Antenna Use	Antenna Type	Transmit/Receive	Tx Bands
1	Primary	PIFA	Transmit and Receive	704 – 716 MHz, 824 – 849 MHz, 1710 – 1755 MHz, 1850 – 1910 MHz
2	Secondary	PIFA	Receive Only	
3	WiFi/BT	PIFA	802.11a/b/g/n, Bluetooth.	2400 - 2485 MHz, 5150 - 5350 MHz, 5500 - 5700 MHz, 5725 - 5850 MHz

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5.4. Simultaneous Transmission Conditions

This device is capable of transmitting simultaneously in certain allowed configurations. These configurations are defined in this section.

The primary cellular antenna can transmit simultaneously with the WiFi/Bluetooth Antenna.

Bluetooth and 2.4GHz WiFi time-share the same antenna and cannot transmit simultaneously. 5.0 GHz WiFi can transmit simultaneously with Bluetooth.

The Wireless Router (hotspot) permits the device to share its cellular data connection with other 2.4 GHz WiFi-enabled devices (channels 1 - 11). WiFi Hotspot mode is NOT supported in 5 GHz WiFi band.

DTM and SVLTE are NOT supported features on this device in any mode.

WWAN & LTE + WiFi

User usage	SAR Test distance	Mode	Mode of Operation	Band	LTE	GPRS/ EGPRS	WCDMA	HSDPA	HSUPA	HSPA+	DC-HSDPA	WiFi 2.4 GHz	WiFi 5.0 GHz	BT 2.4GHz
Body SAR	0cm, Conservative distance with power back-off disabled	Cellular + 2.4GHz WiFi	LTE [a1]	Band 17	Yes	No	No	No	No	No	No	Yes	No	No
			LTE [a1]	Band 4	Yes	No	No	No	No	No	No		No	No
			GPRS [b1]	850	No	Yes	No	No	No	No	No		No	No
			GPRS [b1]	1900	No	Yes	No	No	No	No	No		No	No
			WCDMA [c1]	835	No	No	Yes	No	No	No	No		No	No
			WCDMA [c1]	1900	No	No	Yes	No	No	No	No		No	No
			HSDPA [d1]	835	No	No	No	Yes	No	No	No		No	No
			HSDPA [d1]	1900	No	No	No	Yes	No	No	No		No	No
			HSUPA [e1]	835	No	No	No	No	Yes	No	No		No	No
			HSUPA [e1]	1900	No	No	No	No	Yes	No	No		No	No
			HSPA+ [f1]	835	No	No	No	No	No	Yes	No		No	No
			HSPA+ [f1]	1900	No	No	No	No	No	Yes	No		No	No
			DC-HSDPA [g1]	835	No	No	No	No	No	No	Yes		No	No
			DC-HSDPA [g1]	1900	No	No	No	No	No	No	Yes		No	No
		Cellular + 5.0GHz WiFi	LTE [a1]	Band 17	Yes	No	No	No	No	No	No	No	Yes	No
			LTE [a1]	Band 4	Yes	No	No	No	No	No	No	No		No
			GPRS [b1]	850	No	Yes	No	No	No	No	No	No		No
			GPRS [b1]	1900	No	Yes	No	No	No	No	No	No		No
			WCDMA [c1]	835	No	No	Yes	No	No	No	No	No		No
			WCDMA [c1]	1900	No	No	Yes	No	No	No	No	No		No
			HSDPA [d1]	835	No	No	No	Yes	No	No	No	No		No
			HSDPA [d1]	1900	No	No	No	Yes	No	No	No	No		No
			HSUPA [e1]	835	No	No	No	No	Yes	No	No	No		No
			HSUPA [e1]	1900	No	No	No	No	Yes	No	No	No		No
			HSPA+ [f1]	835	No	No	No	No	No	Yes	No	No		No
			HSPA+ [f1]	1900	No	No	No	No	No	Yes	No	No		No
			DC-HSDPA [g1]	835	No	No	No	No	No	No	Yes	No		No
			DC-HSDPA [g1]	1900	No	No	No	No	No	No	Yes	No		No

Cellular + Bluetooth and Cellular + WiFi + Bluetooth

User usage	SAR Test distance	Mode	Mode of Operation	Band	LTE	GPRS/ EGPRS	WCDMA	HSDPA	HSUPA	HSPA+	DC-HSDPA	WiFi 2.4 GHz	WiFi 5.0 GHz[i1]	BT 2.4GHz[i1]
Body SAR	0cm, Conservative distance with power back-off disabled	Cellular + Bluetooth	LTE [a1]	Band 17	Yes	No	No	No	No	No	No	No	No	Yes
			LTE [a1]	Band 4	Yes	No	No	No	No	No	No	No	No	
			GPRS [b1]	850	No	Yes	No	No	No	No	No	No	No	
			GPRS [b1]	1900	No	Yes	No	No	No	No	No	No	No	
			WCDMA[c1]	835	No	No	Yes	No	No	No	No	No	No	
			WCDMA [c1]	1900	No	No	Yes	No	No	No	No	No	No	
			HSDPA[d1]	835	No	No	No	Yes	No	No	No	No	No	
			HSDPA[d1]	1900	No	No	No	Yes	No	No	No	No	No	
			HSUPA[e1]	835	No	No	No	No	Yes	No	No	No	No	
			HSUPA[e1]	1900	No	No	No	No	Yes	No	No	No	No	
			HSPA+ [f1]	835	No	No	No	No	No	Yes	No	No	No	
			HSPA+ [f1]	1900	No	No	No	No	No	Yes	No	No	No	
			DC-HSDPA[g1]	835	No	No	No	No	No	No	Yes	No	No	
			DC-HSDPA[g1]	1900	No	No	No	No	No	No	Yes	No	No	
		Cellular + 5.0GHz WiFi + Bluetooth	LTE [a1]	Band 17	Yes	No	No	No	No	No	No	No	Yes	Yes
			LTE [a1]	Band 4	Yes	No	No	No	No	No	No	No		
			GPRS [b1]	850	No	Yes	No	No	No	No	No	No		
			GPRS [b1]	1900	No	Yes	No	No	No	No	No	No		
			WCDMA[c1]	835	No	No	Yes	No	No	No	No	No		
			WCDMA [c1]	1900	No	No	Yes	No	No	No	No	No		
			HSDPA[d1]	835	No	No	No	Yes	No	No	No	No		
			HSDPA[d1]	1900	No	No	No	Yes	No	No	No	No		
			HSUPA[e1]	835	No	No	No	No	Yes	No	No	No		
			HSUPA[e1]	1900	No	No	No	No	Yes	No	No	No		
			HSPA+ [f1]	835	No	No	No	No	No	Yes	No	No		
			HSPA+ [f1]	1900	No	No	No	No	No	Yes	No	No		
			DC-HSDPA[g1]	835	No	No	No	No	No	No	Yes	No		
			DC-HSDPA[g1]	1900	No	No	No	No	No	No	Yes	No		

Notes:

a1 – Per KDB 941225 D05 SAR for LTE Devices v01,

- Since, the SAR value is less than 1.45 W/kg, SAR for 100% RB allocation and QPSK modulation is not evaluated.
- SAR evaluation for 5MHz channel bandwidth is not performed, because the maximum average conducted output power of a 5 MHz channel bandwidth is within 0.5 dB of the average conducted output power measured for the 10 MHz channel bandwidth.. Additionally, the SAR for 10 MHz channel bandwidth for all RB configurations is less than 1.45 W/kg.

b1 – Per KDB 941225 D03 SAR Test Reduction GSM/GPRS/EDGE vo1,

c1 – Per KDB 941225 D01 SAR Test for 3G devices v02, SAR for body exposure configurations in data modes is measured using a 12.2 kbps RMC with TPC bits configured to all “1’s”.

d1 – Per KDB 941225 D01 Body SAR is not required for handsets with HSDPA capabilities 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 and the maximum SAR for 12.2 kbps RMC is ≤ 75% of the SAR limit..

e1 – Per 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 12.2 kbps RMC is ≤ 75% of the SAR limit.

f1 – In HSPA+ implementation of this device, 16QAM is not used for uplink. The uplink Category and release number is same as HSUPA, i.e., CAT 6 Rel 6. Therefore, Body SAR is evaluation is not required. Also see note e1.

g1 –In DC-HSDPA implementation of this device, the uplink parameters are the same as HSDPA. No additional channels and modulations (16 QAM, and 64 QAM) are supported in uplink. The difference is only in the downlink parameters, where two carriers are supported. HSDPA settings were used on uplink.

h1 – 5.0 GHz WiFi can transmit simultaneously with Bluetooth.

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6. Proximity Sensor Operation

A Proximity sensor for power reduction is implemented in this device to address RF exposure compliance when the cellular antenna is positioned close to the user's body. The sensor mechanical structure is designed to fit within the enclosure design used in this device and also extended around the edge and top of the antenna element in order to optimize sensitivity in these orientations. This design combines the antenna and proximity sensor into a single FPC (Flexible Printed Circuit).

6.1. Description

The device, model A1430, utilizes a capacitive proximity sensor built into the plastic area that houses the cellular radio antenna. This area can be found on the top edge and the front/Rears of the device, when the device is oriented in the portrait orientation and the I/O port is at the bottom. The purpose of the proximity sensor is to cap the transmitter output power when the device's cellular antenna is proximate to the human body.

For design and testing purposes Top-Edge, Front Surface, and Rear are chosen as the dimensions of interest. The minimum detection distances for these dimensions are: 14 mm (Top-Edge), 14mm (Front), and 11 mm (Rear)

6.2. Test and Calibration of the Proximity Sensor

Every unit from the production line is calibrated and tested to ensure that its operation meets or exceeds the expected detection sensitivity and performance.

An expected capacitance range is programmed in each device, and if the measured capacitance is outside the range during operation of the device, the proximity sensor is triggered and transmits power is capped.

Certain objects may trigger the transmitter output power cap at greater distances. The transmitter output power is capped at different levels depending on the cellular band and modulation in operation.

6.3. Proximity Sensor Detection Area

The proximity sensor is combined with the primary antenna in a single FPC (Flexible Printed Circuit), therefore, the proximity sensor occupies the same area as the primary antenna.

Refer to section 19 for location of proximity sensor

The conservation distance at which proximity sensor is triggered when the

- Top-edge of the device is 14 mm from the phantom.
- Front of the device is 14 mm from the phantom.
- Rear of the device is 11 mm from the phantom.

The following tables show the proximity sensor status as a function of distance from the relevant surfaces of the device.

Proximity Sensor Status Table - Top Edge/Right edge mode in conservative Proximity Sensor Operation

Distance to Top-edge/Right edge of DUT (mm)	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00
Proximity Sensor Status	ON	ON	ON	ON	ON	OFF	OFF	OFF

Proximity Sensor Status Table - Rear in conservative Proximity Sensor Operation

Distance to Rear of DUT (mm)	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00
Proximity Sensor Status	ON	ON	ON	ON	OFF	OFF	OFF	OFF

Proximity Sensor Status Table – Front Surface in conservative Proximity Sensor Operation

Distance to Front Surface of DUT (mm)	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00
Proximity Sensor Status	ON	ON	ON	ON	ON	OFF	OFF	OFF

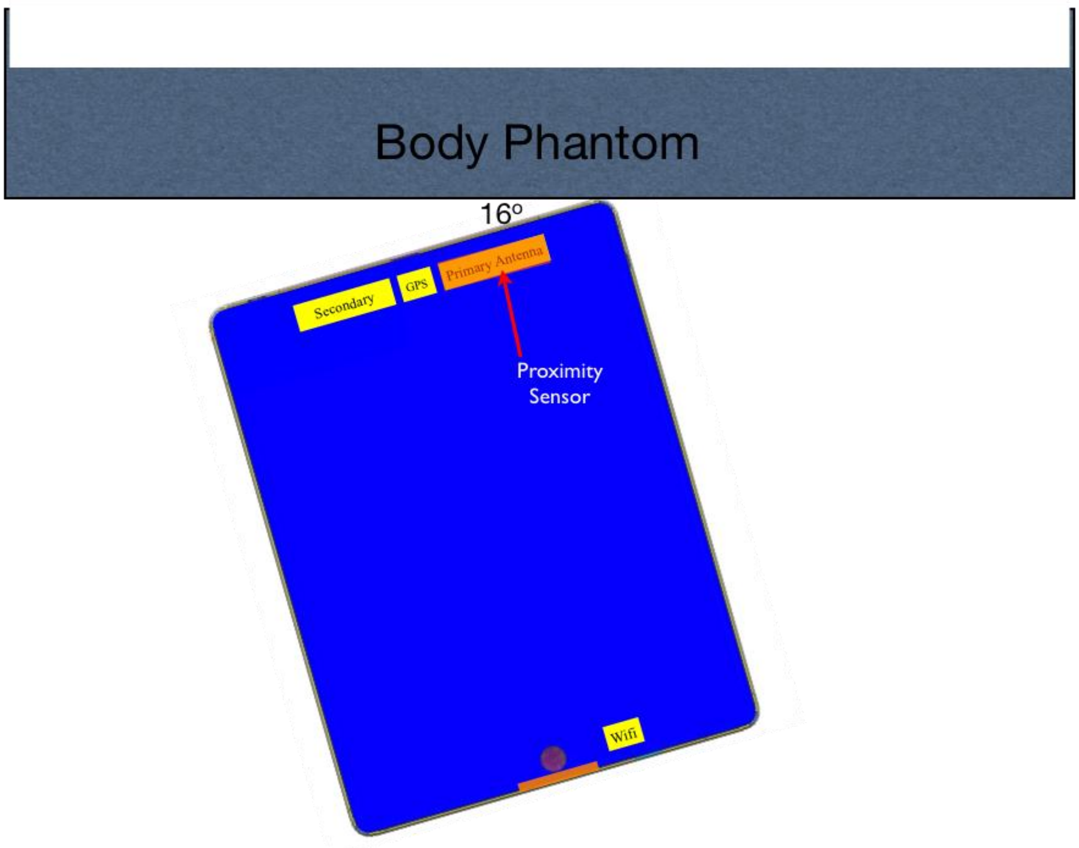
Since the primary antenna is 35.1mm from the edge of the device, additional testing is performed to evaluate the coverage of the proximity sensor detection area.

6.4. Coverage at the Corner of the DUT

To evaluate the proximity sensor coverage at the top right corner of the device, the angle at which proximity sensor stop triggering is determined. In this case, the conservative angle at which proximity sensor stops triggering is at 16°.

Proximity Sensor Status Table – Top Edge/Right corner in conservative Proximity Sensor Operation

Angle of Top-edge/Right corner of DUT (°)	0	5	10	15	16	20	25	30	35	40	45
Proximity Sensor Status	ON	ON	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF



The proximity sensor coverage at the Rear Surface/Right-corner of the device is determined by changing the angle of the device relative to the phantom and observing the angle at which the proximity sensor is no longer triggered. In this case, the conservative angle at which proximity sensor stops triggering is at 20°.

6.5. Special Development Software

During the 14 mm (Top-Edge), Rear (11mm), and 15° angle (0mm) the transmit power cap normally enabled by the proximity sensor, was disabled using a series of test commands which are only available in development software. The proximity sensor or the power reduction can’t be intentionally or unintentionally turned-off by the user. The software provided on production units will not allow the proximity sensor or the power cap to be disabled.

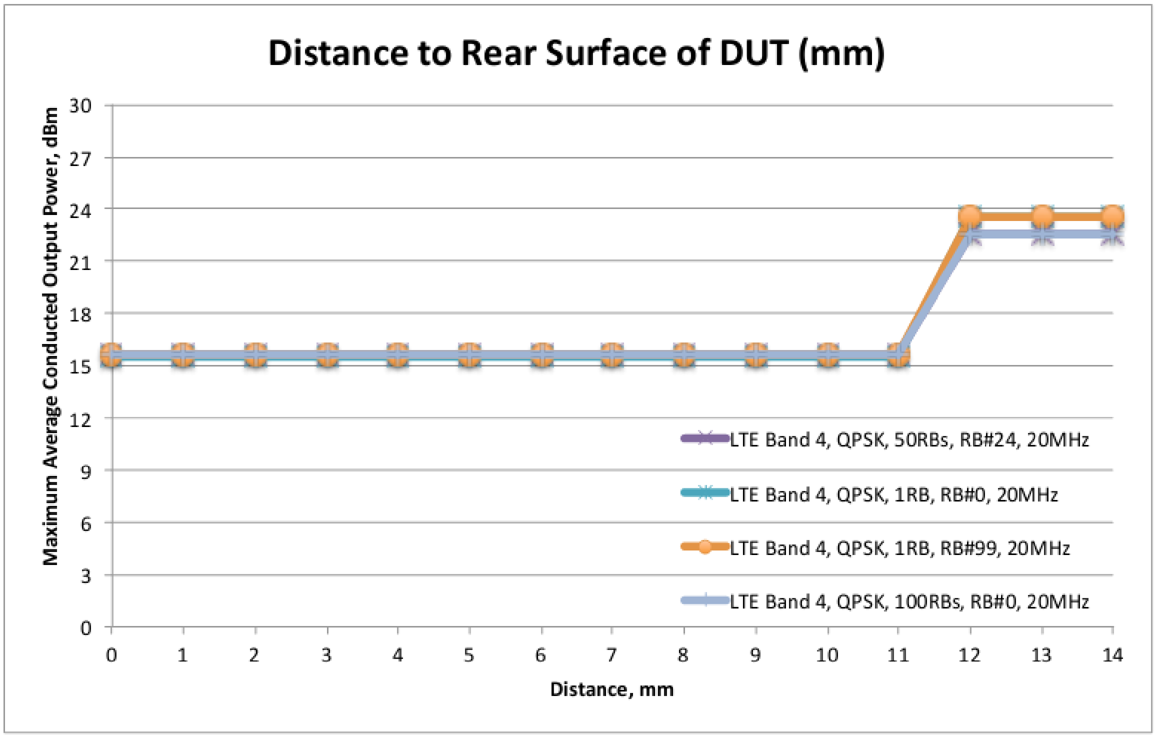
6.6. Power Reduction Values

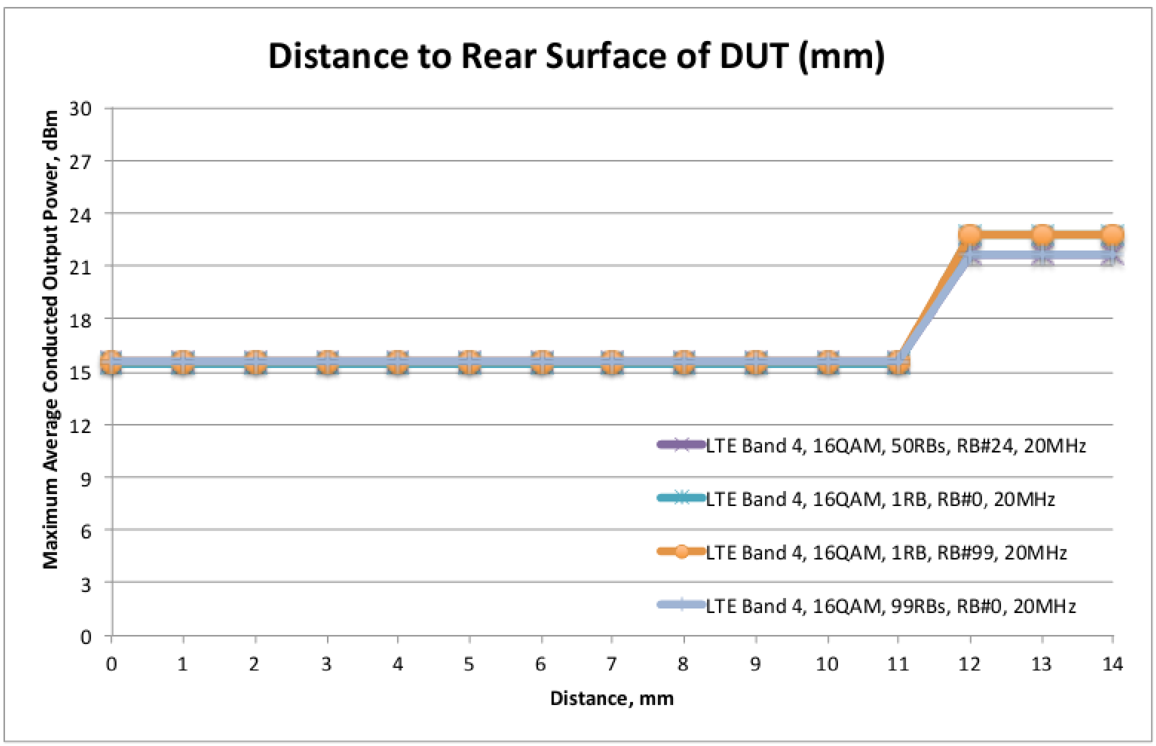
The measured power reduction in each air-interface is listed below. The power reduction values are same for Top-edge, Front and Rear.

The following tables show the power vs distance plots for

- Rear
- Top Edge

of the DUT with the proximity sensor enabled.


Distance to Rear Surface of DUT (mm)
Maximum Average Conducted Output Power, dBm
30
27
24
21
18
15
12
9
6
3
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
Distance, mm
LTE Band 4, QPSK, 50RBs, RB#24, 20MHz
LTE Band 4, QPSK, 1RB, RB#0, 20MHz
LTE Band 4, QPSK, 1RB, RB#99, 20MHz
LTE Band 4, QPSK, 100RBs, RB#0, 20MHz


Distance to Rear Surface of DUT (mm)
Maximum Average Conducted Output Power, dBm
30
27
24
21
18
15
12
9
6
3
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
Distance, mm
LTE Band 4, 16QAM, 50RBs, RB#24, 20MHz
LTE Band 4, 16QAM, 1RB, RB#0, 20MHz
LTE Band 4, 16QAM, 1RB, RB#99, 20MHz
LTE Band 4, 16QAM, 99RBs, RB#0, 20MHz

7. RF Output Power Measurement

7.1. LTE

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	-	-	-	-	-

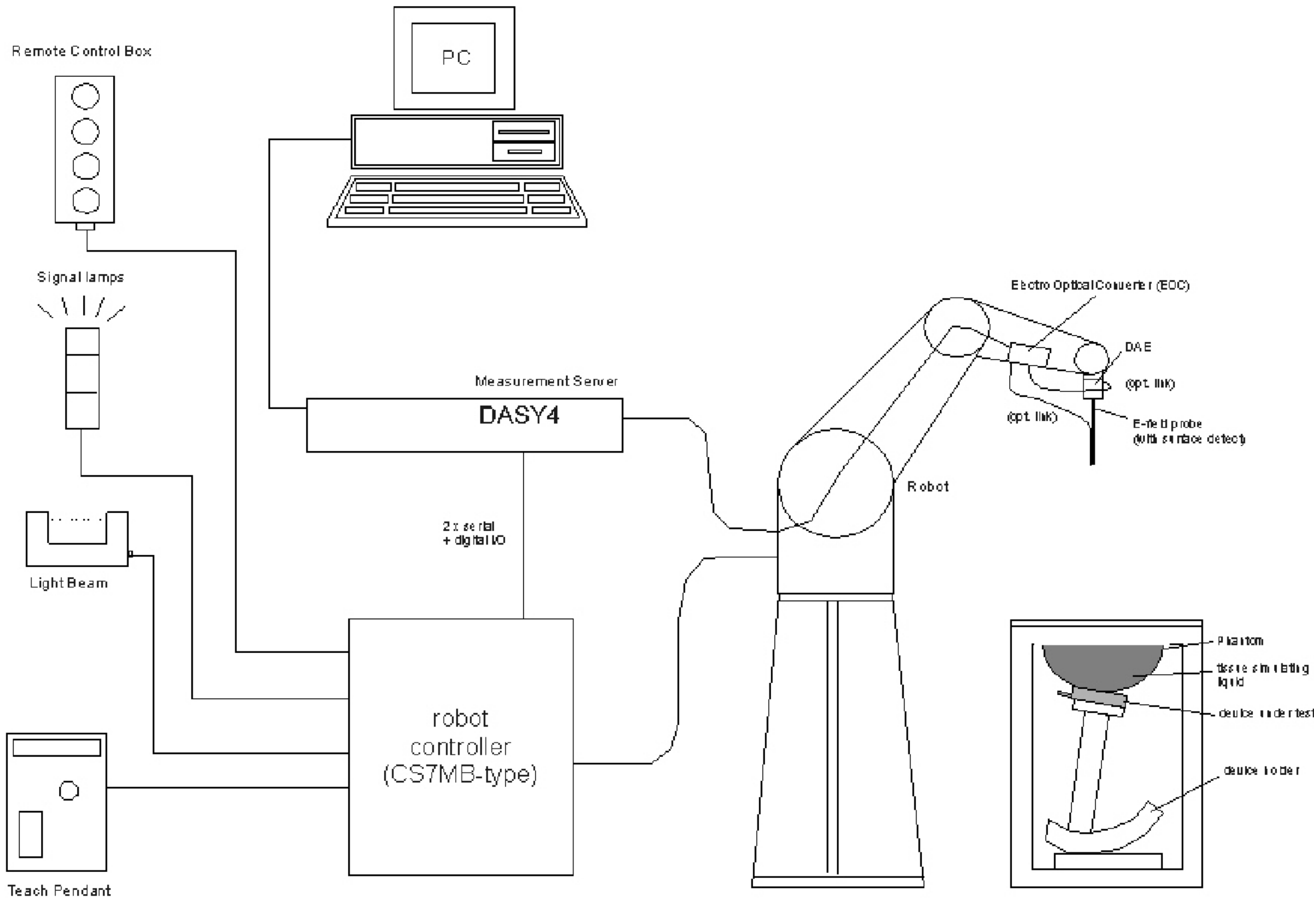
Note 1: Applies to the lower block of Band 23, i.e. a carrier placed in the 2000-2010 MHz region.

Band	BW	Ch	Freq. (MHz)	Mode	UL RB Allocation	UL RB Start	Target MPR	Measure MPR	Tx Conducted Power (dBm) W/o Pwr back-off	Tx Conducted Power (dBm) *W/ Pwr back-off
4	20	20050	1720.0	QPSK	50	24	1	1	22.5	15.6
					1	0	0	0	23.6	15.2
					1	99	0	0	23.6	15.6
					100	0	1	1	22.5	15.5
				16QAM	50	24	2	2	21.5	15.6
					1	0	1	1	22.6	15.3
					1	99	1	1	22.6	15.6
					100	0	2	2	21.6	15.4
		20175	1732.5	QPSK	50	24	1	1	22.6	15.6
					1	0	0	0	23.6	15.2
					1	99	0	0	23.6	15.2
					100	0	1	1	22.6	15.4
				16QAM	50	24	2	2	21.6	15.6
					1	0	1	1	22.6	15.3
					1	99	1	1	22.6	15.3
					100	0	2	2	21.7	15.4
		20300	1745.0	QPSK	50	24	1	1	22.6	15.6
					1	0	0	0	23.6	15.5
					1	99	0	0	23.6	15.5
					100	0	1	1	22.6	15.6
				16QAM	50	24	2	2	21.6	15.6
					1	0	1	1	22.7	15.4
					1	99	1	1	22.7	15.4
					100	0	2	2	21.6	15.6
	15	20025	1717.5	QPSK	36	18	1	1	22.5	15.5
					1	0	0	0	23.5	15.5
					1	74	0	0	23.5	15.4
					75	0	1	1	22.6	15.4
				16QAM	36	18	2	2	21.5	15.5
					1	0	1	1	22.5	15.4
					1	74	1	1	22.4	15.3
					75	0	2	2	21.5	15.5
		20175	1732.5	QPSK	36	18	1	1	22.5	15.5
					1	0	0	0	23.5	15.2
					1	74	0	0	23.6	15.2
					75	0	1	1	22.6	15.4
				16QAM	36	18	2	2	21.5	15.4
					1	0	1	1	22.5	15.3
					1	74	1	1	22.5	15.3
					75	0	2	2	21.6	15.4
		20325	1747.5	QPSK	36	18	1	1	22.6	15.6
					1	0	0	0	23.6	15.3
					1	74	0	0	23.6	15.3
					75	0	1	1	22.6	15.5
				16QAM	36	18	2	2	21.6	15.5
					1	0	1	1	22.6	15.3
					1	74	1	1	22.5	15.2
					75	0	2	2	21.6	15.5

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.

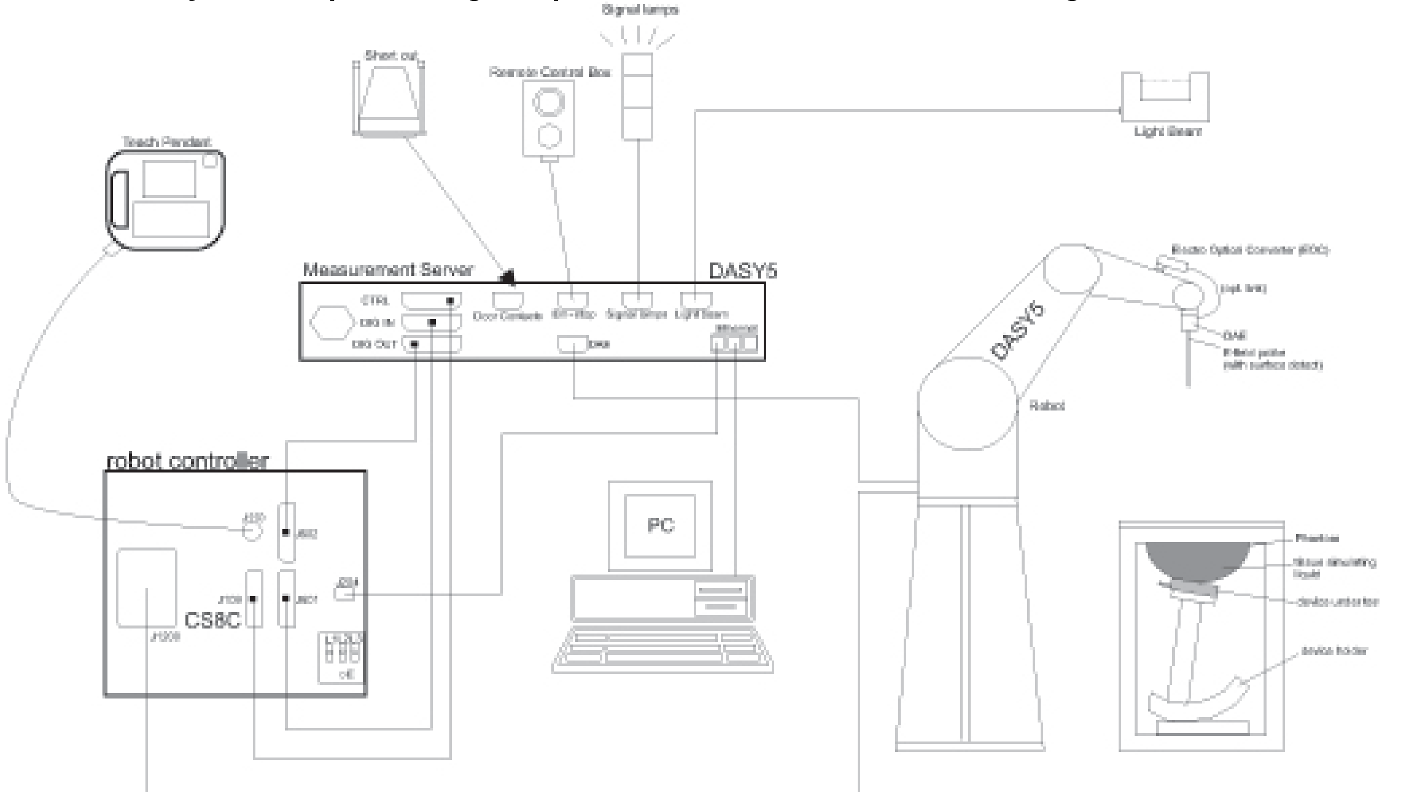
8. Measurement System Description and Setup

The DASY4 system 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. The probe is equipped with an optical surface detector system.
- 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 2000 or 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.

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



- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic Field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running WinXP or Win7 and the DASY5 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

9. Composition of Ingredients for Tissue Simulating Liquids

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%

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10. Liquid Parameters

The simulating liquids should be checked at the beginning of a series of SAR measurements to determine of the dielectric parameters are within the tolerances of the specified target values. For frequencies in 300 MHz to just under 2 GHz, the measured conductivity and relative permittivity should be within ± 5% of the target values. For frequencies in the range of 2–3 GHz and above the measured conductivity should be within ± 5% of the target values. The measured relative permittivity tolerance can be relaxed to no more than ± 10%.

Reference Values of Tissue Dielectric Parameters for Head & Body Phantom

The body tissue parameters that have not been specified in P1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations and extrapolated according to the head parameters specified in IEEE Standard 1528.

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

(ε_r = relative permittivity, σ = conductivity and ρ = 1000 kg/m^3)

Reference Values of Tissue Dielectric Parameters for Body Phantom (for 3000 MHz – 5800 MHz)

In the current guidelines and draft standards for compliance testing of mobile phones (i.e., IEEE P1528, OET 65 Supplement C), the dielectric parameters suggested for head and body tissue simulating liquid are given only at 3.0 GHz and 5.8 GHz. As an intermediate solution, dielectric parameters for the frequencies between 5 to 5.8 GHz were obtained using linear interpolation (see table below).
SPEAG has developed suitable head and body tissue simulating liquids consisting of the following ingredients: de-ionized water, salt and a special composition including mineral oil and an emulgators. Dielectric parameters of these liquids were measured suing a HP 8570C Dielectric Probe Kit in conjunction with HP 8753ES Network Analyzer (30 kHz – 6G Hz).

Target Frequency (MHz)	Head		Body	
	ε_r	σ (S/m)	ε_r	σ (S/m)
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

(ε_r = relative permittivity, σ = conductivity and ρ = 1000 kg/m^3)

10.1. Liquid Check Results

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
02/24/2012	Body 1720	e'	51.6708	Relative Permittivity (ε_r):	51.67	53.52	-3.45	5
		e"	15.1451	Conductivity (σ):	1.45	1.47	-1.31	5
	Body 1735	e'	51.6376	Relative Permittivity (ε_r):	51.64	53.48	-3.44	5
		e"	15.1771	Conductivity (σ):	1.46	1.48	-0.86	5
	Body 1750	e'	51.5984	Relative Permittivity (ε_r):	51.60	53.44	-3.45	5
		e"	15.2091	Conductivity (σ):	1.48	1.49	-0.42	5
02/24/2012	Body 1720	e'	51.2487	Relative Permittivity (ε_r):	51.25	53.52	-4.24	5
		e"	14.9633	Conductivity (σ):	1.43	1.47	-2.50	5
	Body 1735	e'	51.2375	Relative Permittivity (ε_r):	51.24	53.48	-4.19	5
		e"	15.0067	Conductivity (σ):	1.45	1.48	-1.98	5
	Body 1750	e'	51.2312	Relative Permittivity (ε_r):	51.23	53.44	-4.14	5
		e"	15.0511	Conductivity (σ):	1.46	1.49	-1.45	5
02/25/2012	Body 1720	e'	51.6495	Relative Permittivity (ε_r):	51.65	53.52	-3.49	5
		e"	15.2963	Conductivity (σ):	1.46	1.47	-0.33	5
	Body 1735	e'	51.5974	Relative Permittivity (ε_r):	51.60	53.48	-3.52	5
		e"	15.3345	Conductivity (σ):	1.48	1.48	0.16	5
	Body 1750	e'	51.5380	Relative Permittivity (ε_r):	51.54	53.44	-3.56	5
		e"	15.3688	Conductivity (σ):	1.50	1.49	0.63	5
02/26/2012	Body 1720	e'	51.7681	Relative Permittivity (ε_r):	51.77	53.52	-3.27	5
		e"	14.9845	Conductivity (σ):	1.43	1.47	-2.36	5
	Body 1735	e'	51.7192	Relative Permittivity (ε_r):	51.72	53.48	-3.29	5
		e"	15.0225	Conductivity (σ):	1.45	1.48	-1.87	5
	Body 1750	e'	51.6676	Relative Permittivity (ε_r):	51.67	53.44	-3.32	5
		e"	15.0556	Conductivity (σ):	1.46	1.49	-1.42	5
02/27/2012	Body 1720	e'	52.0522	Relative Permittivity (ε_r):	52.05	53.52	-2.74	5
		e"	14.9557	Conductivity (σ):	1.43	1.47	-2.55	5
	Body 1735	e'	52.0071	Relative Permittivity (ε_r):	52.01	53.48	-2.75	5
		e"	14.9939	Conductivity (σ):	1.45	1.48	-2.06	5
	Body 1750	e'	51.9523	Relative Permittivity (ε_r):	51.95	53.44	-2.79	5
		e"	15.0361	Conductivity (σ):	1.46	1.49	-1.55	5
02/27/2012	Body 1720	e'	52.4337	Relative Permittivity (ε_r):	52.43	53.52	-2.03	5
		e"	15.2562	Conductivity (σ):	1.46	1.47	-0.59	5
	Body 1735	e'	52.3812	Relative Permittivity (ε_r):	52.38	53.48	-2.05	5
		e"	15.3062	Conductivity (σ):	1.48	1.48	-0.02	5
	Body 1750	e'	52.3271	Relative Permittivity (ε_r):	52.33	53.44	-2.08	5
		e"	15.3576	Conductivity (σ):	1.49	1.49	0.55	5
02/28/2012	Body 1720	e'	51.2228	Relative Permittivity (ε_r):	51.22	53.52	-4.29	5
		e"	14.9755	Conductivity (σ):	1.43	1.47	-2.42	5
	Body 1735	e'	51.1807	Relative Permittivity (ε_r):	51.18	53.48	-4.30	5
		e"	15.0139	Conductivity (σ):	1.45	1.48	-1.93	5
	Body 1750	e'	51.1320	Relative Permittivity (ε_r):	51.13	53.44	-4.32	5
		e"	15.0511	Conductivity (σ):	1.46	1.49	-1.45	5
02/28/2012	Body 1720	e'	50.9909	Relative Permittivity (ε_r):	50.99	53.52	-4.72	5
		e"	14.9607	Conductivity (σ):	1.43	1.47	-2.51	5
	Body 1735	e'	50.9463	Relative Permittivity (ε_r):	50.95	53.48	-4.74	5
		e"	15.0049	Conductivity (σ):	1.45	1.48	-1.99	5
	Body 1750	e'	50.9011	Relative Permittivity (ε_r):	50.90	53.44	-4.75	5
		e"	15.0489	Conductivity (σ):	1.46	1.49	-1.47	5

11. 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, IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan). If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly.

Step 3: Zoom Scan
Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The Zoom Scan measures ≥ 7x7x9 (above 4.5 GHz) or 5x5x7 (below 3 GHz) points within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the Zoom Scan evaluates the averaged SAR for 1 g and 10 g and displays these values next to the job's label.

Step 4: Power drift measurement
The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

Step 5: Z-Scan
The Z Scan measures points along a vertical straight line. The line runs along the Z-axis of a one-dimensional grid. In order to get a reasonable extrapolation, the extrapolated distance should not be larger than the step size in Z-direction.

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%.

System Performance Check Measurement Conditions

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

Reference SAR Values for HEAD & BODY-tissue from calibration certificate of SPEAG.

System Dipole	Serial No.	Cal. Date	Freq. (MHz)	SAR Measured (mW/g)		
				1g/10g	Head	Body
D1750V2	1053	5/27/11	1750	1g	36.1	36.9
				10g	19.2	19.7
D1750V2	1050	4/19/11	1750	1g	36.8	36.4
				10g	19.6	19.4

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12.1. System Performance Check Results

Date Tested	System validation dipole		Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
2/24/2012	Body	1750	1g SAR	36.2	37.5	-3.47	±10
			10g SAR	19.2	19.9	-3.52	
2/25/2012	Body	1750	1g SAR	36.9	37.5	-1.60	±10
			10g SAR	19.6	19.9	-1.51	
2/26/2012	Body	1750	1g SAR	36.6	37.5	-2.40	±10
			10g SAR	19.3	19.9	-3.02	
2/27/2012	Body	1750	1g SAR	36.8	37.5	-1.87	±10
			10g SAR	19.4	19.9	-2.51	
2/27/2012	Body	1750	1g SAR	39.1	36.4	7.42	±10
			10g SAR	20.6	19.4	6.19	
2/28/2012	Body	1750	1g SAR	37.5	36.4	3.02	±10
			10g SAR	19.8	19.4	2.06	
2/28/2012	Body	1750	1g SAR	39.1	36.4	7.42	±10
			10g SAR	20.6	19.4	6.19	

13. SAR Test Results

13.1. LTE Band 4

Test mode reduction considerations

SAR evaluation for 15MHz channel bandwidth is not performed, because the maximum average conducted output power of a 15 MHz channel bandwidth is within 0.5 dB of the average conducted output power measured for the 20 MHz channel bandwidth.

20MHz Channel Bandwidth

Test position	dist. (mm)	Pwr back-off	Mode	Ch #	Freq. (MHz)	UL RB Allocation	UL RB Start	MPR	Avg Pwr (dBm)	SAR (mW/g) 1-g	Note
Rear	0	Yes	QPSK	20050	1720.0	50	24	1	15.6	1.090	
						1	0	0	15.2	0.755	
						1	99	0	15.6	1.050	
						100	0	1	15.5		1
			16QAM			50	24	2	15.6	1.090	
						1	0	1	15.3	0.785	
						1	99	1	15.6	1.080	
						100	0	2	15.4		1
			QPSK	20175	1732.5	50	24	1	15.6	1.060	
						1	0	0	15.2	0.929	
						1	99	0	15.2	0.735	
						100	0	1	15.4		1
			16QAM			50	24	2	15.6	1.040	
						1	0	1	15.3	0.968	
						1	99	1	15.3	0.760	
						100	0	2	15.4		1
			QPSK	20300	1745.0	50	24	1	15.6	0.963	
						1	0	0	15.5	0.862	
						1	99	0	15.5	0.919	
						100	0	1	15.6		1
			16QAM			50	24	2	15.6	0.971	
						1	0	1	15.4	0.922	
						1	99	1	15.4	0.976	
						100	0	2	15.6		1
Top	0	Yes	QPSK	20050	1720.0	50	24	1	15.6	0.864	
						1	0	0	15.2	0.607	
						1	99	0	15.6	0.849	
						100	0	1	15.5		1
			16QAM			50	24	2	15.6	0.852	
						1	0	1	15.3	0.634	
						1	99	1	15.6	0.888	
						100	0	2	15.4		1
			QPSK	20175	1732.5	50	24	1	15.6	0.932	
						1	0	0	15.2	0.776	
						1	99	0	15.2	0.628	
						100	0	1	15.4		1
			16QAM			50	24	2	15.6	0.913	
						1	0	1	15.3	0.811	
						1	99	1	15.3	0.640	
						100	0	2	15.4		1
			QPSK	20300	1745.0	50	24	1	15.6	0.739	
						1	0	0	15.5	0.694	
						1	99	0	15.5	0.648	
						100	0	1	15.6		1
			16QAM			50	24	2	15.6	0.733	
						1	0	1	15.4	0.738	
						1	99	1	15.4	0.702	
						100	0	2	15.6		1

Note(s):

1. 100% RB Allocation in QPSK and 16QAM is not needed due to the SAR result is < 1.45 mW/g from 50% RB Allocation. The data has not been considered for FCC Equipment Certification.

20MHz Channel Bandwidth (continued)

Test position	dist. (mm)	Pwr back-off	Mode	Ch #	Freq. (MHz)	UL RB Allocation	UL RB Start	MPR	Avg Pwr (dBm)	SAR (mW/g) 1-g	Note
Right	0	No	QPSK	20050	1720.0	50	24	1	22.5		2
						1	0	0	23.6		2
						1	99	0	23.6		2
						100	0	1	22.5		2
			16QAM			50	24	2	21.5		2
						1	0	1	22.6		2
						1	99	1	22.6		2
						100	0	2	21.6		1
			QPSK	20175	1732.5	50	24	1	22.6	0.365	
						1	0	0	23.6	0.455	
						1	99	0	23.6	0.471	
						100	0	1	22.6		1
			16QAM			50	24	2	21.6	0.297	
						1	0	1	22.6	0.364	
						1	99	1	22.6	0.389	
						100	0	2	21.7		1
			QPSK	20300	1745.0	50	24	1	22.6		2
						1	0	0	23.6		2
						1	99	0	23.6		2
						100	0	1	22.6		1
			16QAM			50	24	2	21.6		2
						1	0	1	22.7		2
						1	99	1	22.7		2
						100	0	2	21.6		1
Rear	11	No	QPSK	20050	1720.0	50	24	1	22.5	0.713	
						1	0	0	23.6	0.912	
						1	99	0	23.6	0.935	
						100	0	1	22.5		1
			16QAM			50	24	2	21.5	0.583	
						1	0	1	22.6	0.772	
						1	99	1	22.6	0.775	
						100	0	2	21.6		1
			QPSK	20175	1732.5	50	24	1	22.6	0.763	
						1	0	0	23.6	0.944	
						1	99	0	23.6	1.020	
						100	0	1	22.6		1
			16QAM			50	24	2	21.6	0.622	
						1	0	1	22.6	0.789	
						1	99	1	22.6	0.845	
						100	0	2	21.7		1
			QPSK	20300	1745.0	50	24	1	22.6	0.752	
						1	0	0	23.6	0.909	
						1	99	0	23.6	0.956	
						100	0	1	22.6		1
			16QAM			50	24	2	21.6	0.606	
						1	0	1	22.7	0.756	
						1	99	1	22.7	0.795	
						100	0	2	21.6		1

Note(s):

1. 100% RB Allocation in QPSK and 16QAM is not needed due to the SAR result is < 1.45 mW/g from 50% RB Allocation. The data has not been considered for FCC Equipment Certification.
2. Mid. Channel SAR value not over 0.8, therefore low and high channel SAR is not necessary.

20MHz Channel Bandwidth (continued)

Test position	dist. (mm)	Pwr back-off	Mode	Ch #	Freq. (MHz)	UL RB Allocation	UL RB Start	MPR	Avg Pwr (dBm)	SAR (mW/g) 1-g	Note
Top	14	No	QPSK	20050	1720.0	50	24	1	22.5	0.661	
						1	0	0	23.6	0.832	
						1	99	0	23.6	0.843	
						100	0	1	22.5		1
			16QAM			50	24	2	21.5	0.527	
						1	0	1	22.6	0.704	
						1	99	1	22.6	0.712	
						100	0	2	21.6		1
			QPSK	20175	1732.5	50	24	1	22.6	0.682	
						1	0	0	23.6	0.852	
						1	99	0	23.6	0.905	
						100	0	1	22.6		1
			16QAM			50	24	2	21.6	0.563	
						1	0	1	22.6	0.710	
						1	99	1	22.6	0.761	
						100	0	2	21.7		1
			QPSK	20300	1745.0	50	24	1	22.6	0.710	
						1	0	0	23.6	0.874	
						1	99	0	23.6	0.901	
						100	0	1	22.6		1
			16QAM			50	24	2	21.6	0.580	
						1	0	1	22.7	0.734	
						1	99	1	22.7	0.758	
						100	0	2	21.6		1
Top edge/ Right corner at 15°	0	No	QPSK	20050	1720.0	50	24	1	22.5	0.586	
						1	0	0	23.6	0.770	
						1	99	0	23.6	0.735	
						100	0	1	22.5		1
			16QAM			50	24	2	21.5	0.465	
						1	0	1	22.6	0.655	
						1	99	1	22.6	0.621	
						100	0	2	21.6		1
			QPSK	20175	1732.5	50	24	1	22.6	0.572	
						1	0	0	23.6	0.708	
						1	99	0	23.6	0.758	
						100	0	1	22.6		1
			16QAM			50	24	2	21.6	0.483	
						1	0	1	22.6	0.626	
						1	99	1	22.6	0.647	
						100	0	2	21.7		1
			QPSK	20300	1745.0	50	24	1	22.6	0.649	
						1	0	0	23.6	0.792	
						1	99	0	23.6	0.797	
						100	0	1	22.6		1
			16QAM			50	24	2	21.6	0.507	
						1	0	1	22.7	0.639	
						1	99	1	22.7	0.675	
						100	0	2	21.6		1

Note(s):

1. 100% RB Allocation in QPSK and 16QAM is not needed due to the SAR result is < 1.45 mW/g from 50% RB Allocation. The data has not been considered for FCC Equipment Certification.

20MHz Channel Bandwidth (continued)

Test position	dist. (mm)	Pwr back-off	Mode	Ch #	Freq. (MHz)	UL RB Allocation	UL RB Start	MPR	Avg Pwr (dBm)	SAR (mW/g) 1-g	Note
Top edge/ Rear corner at 41°	0	Yes	QPSK	20050	1720.0	50	24	1	15.6	1.060	
						1	0	0	15.2	0.815	
						1	99	0	15.6	1.070	
						100	0	1	15.5		1
			16QAM			50	24	2	15.6	1.070	
						1	0	1	15.3	0.853	
						1	99	1	15.6	1.110	
						100	0	2	15.4		1
			QPSK	20175	1732.5	50	24	1	15.6	**1.160**	
						1	0	0	15.2	0.947	
						1	99	0	15.2	0.794	
						100	0	1	15.4		1
			16QAM			50	24	2	15.6	1.160	
						1	0	1	15.3	0.998	
						1	99	1	15.3	0.823	
						100	0	2	15.4		1

Note(s):

1. 100% RB Allocation in QPSK and 16QAM is not needed due to the SAR result is < 1.45 mW/g from 50% RB Allocation. The data has not been considered for FCC Equipment Certification.

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14. Summary of Highest 1g SAR

FCC rule part	Technology/Band	Test configuration	Mode	Separation distance (mm)	Highest 1g SAR (W/kg)
27	LTE band 4	Top edge/ Rear corner at 41°	QPSK (RB 50/24)	0	1.16

15. Worst-case SAR Plots

Test Laboratory: UL CCS SAR Lab A

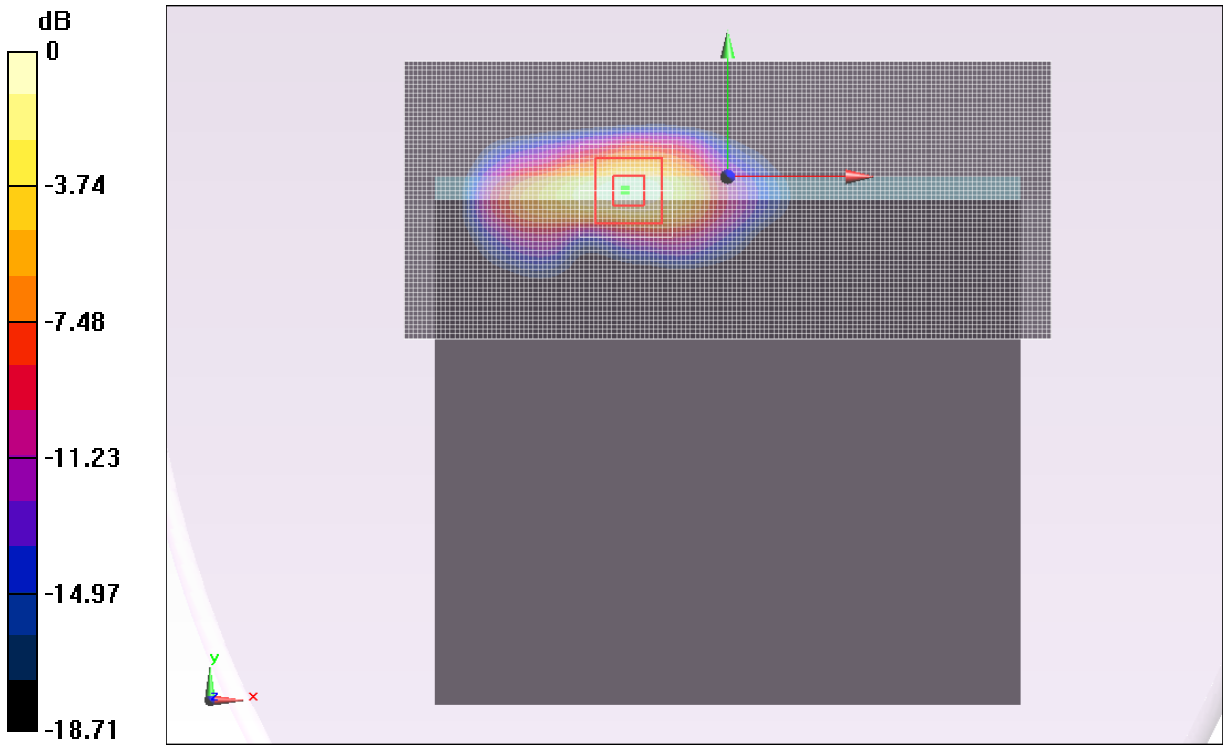
Date: 2/24/2012

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 = 1.446 mho/m; ε_r = 51.238; ρ = 1000 kg/m^3
DASY5 Configuration:
- Electronics: DAE4 Sn1239; Calibrated: 10/18/2011
- Probe: EX3DV4 - SN3772; ConvF(7.55, 7.55, 7.55); 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

Top_Tilt 41 deg./M ch_QPSK_RB50_RB24_/Area Scan (141x61x1): Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 1.605 mW/g

Top_Tilt 41 deg./M ch_QPSK_RB50_RB24_/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 32.837 V/m; Power Drift = 0.10 dB
Peak SAR (extrapolated) = 2.3710
SAR(1 g) = 1.16 mW/g; SAR(10 g) = 0.542 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.664 mW/g



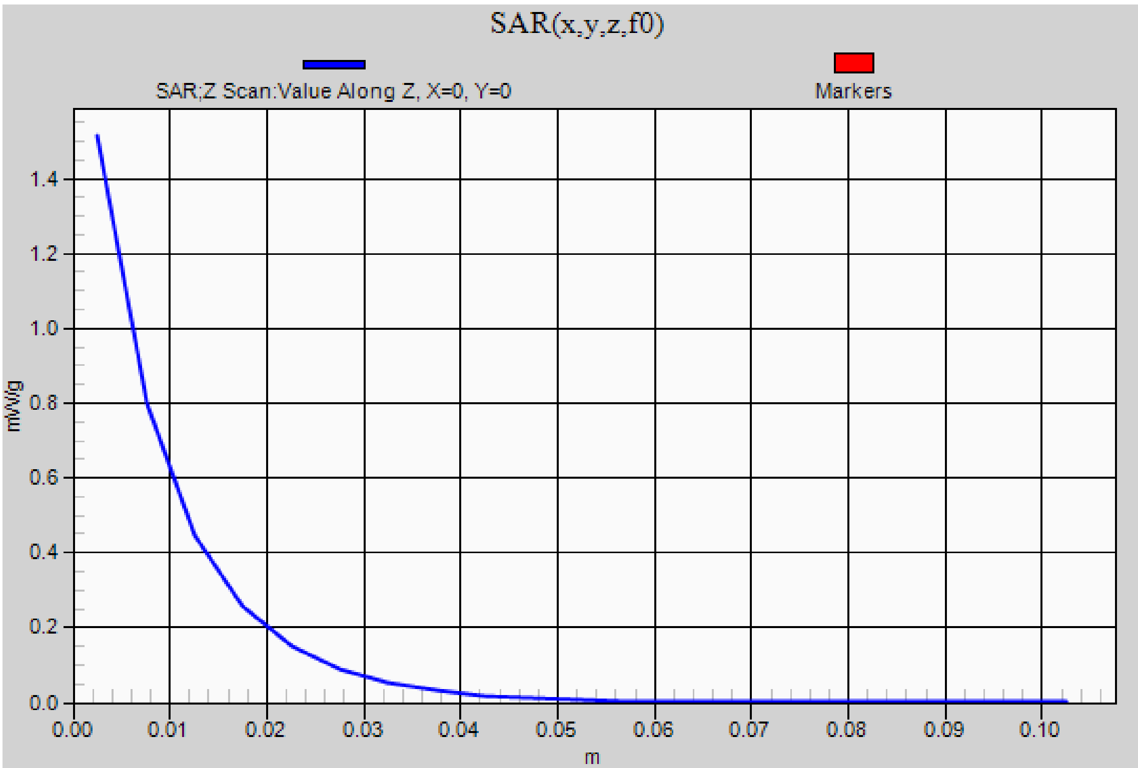
0 dB = 1.660mW/g = 4.40 dB mW/g

Test Laboratory: UL CCS SAR Lab A Date: 2/24/2012

LTE Band 4

Frequency: 1732.5 MHz; Duty Cycle: 1:1

Top_Tilt 41 deg./M ch_QPSK_RB50_RB24_/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.514 mW/g



16. Simultaneous Transmission SAR Analysis

The Bluetooth's output power is < 25 mW [60/$f_{(GHz)}$], which stand-alone SAR evaluation is not required. Therefore, simultaneous transmission SAR evaluation is not required.

SVDO and SVLTE are NOT supported features on this device

16.1. Body exposure condition (LTE Bands + WiFi 2.4 GHz)

Test Position	Data	Data	Sum of 1g SAR (mW/g)
	(1) LTE Band 4 (20MHz BW)	(2) WiFi 2.4G	
Rear	1.090	0.093	1.183
Right	0.932	0.053	0.985
Top	0.905	0	0.905
Bottom	0	1.190	1.190

Conclusions:
Simultaneous transmission SAR is not required because the sum of the 1-g SAR is < 1.6 W/kg

16.2. Body exposure condition (LTE Bands + WiFi 5 GHz Bands)

Test Position	Data	Data				Sum of 1g SAR (mW/g)
	(1) LTE Band 4 (20MHz BW)	(2) WiFi 5.2G	(3) WiFi 5.3G	(4) WiFi 5.5G	(5) WiFi 5.8G	
Rear	1.09	0.038				1.128
	1.09		0.113			1.203
	1.09			0.063		1.153
	1.09				0.057	1.147
Right	0.932	0.047				0.979
	0.932		0.058			0.990
	0.932			0.014		0.946
	0.932				0.028	0.960
Top	0.905	0				0.905
	0.905		0			0.905
	0.905			0		0.905
	0.905				0	0.905
Bottom	0	0.522				0.522
	0		1.000			1.000
	0			0.946		0.946
	0				1.110	1.110

Conclusions:
Simultaneous transmission SAR is not required because the sum of the 1-g SAR is < 1.6 W/kg

17. Appendixes

Refer to separated files for the following appendixes.

17.1. System check plots

17.2. SAR test plots for LTE Band 4

17.3. Calibration certificate for E-Field Probe EX3DV4 SN 3772

17.4. Calibration certificate for E-Field Probe EX3DV4 SN 3749

17.5. Calibration Certificate for D1750V2 SN 1050

17.6. Calibration Certificate for D1750V2 SN 1053

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18. Summary of Test Configurations

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

18.1. Exposure conditions for WWAN and LTE

Configuration	Antenna-to-edge/surface	SAR Required	note
Rear	2.14 mm	Yes	SAR evaluated with the base/bottom of the tablet in direct contact with a flat phantom as per KDB 447498 4) b) i)
Top edge	3.7 mm	Yes	This is the most conservative antenna-to-user distance at edge mode as per KDB 447498 4) b) ii) (2)
Top edge/Right corner at 15°	>3.7 mm	Yes	This is the most conservative antenna-to-user angle at Top-Edge/Right Corner at which proximity sensor is triggered.
Top edge/Rear corner at 41°	1.98 mm	Yes	Since, the Top-Edge of the tablet is rounded, this is the most conservative antenna-to-user distance/angle at edge mode as per KDB 447498 4)B)ii) (2).
Bottom	225.5 mm	No	> 20 cm
Left edge	99.8mm	No	This is not the most conservative antenna-to-user distance at edge mode as per KDB 447498 4) b) ii) (2)
Right edge	35.1 mm	Yes	This is the most conservative antenna-to-user distance at edge mode compared with Left edge