**FCC OET BULLETIN 65 SUPPLEMENT C 01-01**
**IEEE 1528:2003**
**RSS-102 Issue 4, March 2010**
**IEC 62209-2:2010**

# SAR EVALUATION REPORT

**For**
**Apple iPad**

**MODEL: A1403**
**FCC ID: BCGA1403**
**IC: 579C-A1403**

**REPORT NUMBER: 11U13938-7B1**

**ISSUE DATE: February 13, 2012**

*Prepared for*
**APPLE INC.**
**1 INFINITE LOOP, MS 26A**
**CUPERTINO, CA 95014-2084**

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

NVLAP LAB CODE 200065-0

## Revision History

| Rev. | Issue Date | Revisions | Revised By |
|---|---|---|---|
| A | December 21, 2011 | Initial Issue | -- |
| B | January 23, 2012 | Added additional test for Top edge/Rear corner at 41° configuration | Devin Chang |
| B1 | February 13, 2012 | Added another footnote under Section 13.8 per FCC's request | Sunny Shih |

# Table of Contents

# 1. Attestation of Test Results

| | | | |
|---|---|---|---|
| Applicant: | APPLE INC. | | |
| EUT description: | The Apple iPad, Model A1403 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 CDMA/GSM 2G/3G/LTE data radio functions | | |
| Model number: | A1403 | | |
| Device category: | Portable | | |
| Exposure category: | General Population/Uncontrolled Exposure | | |
| Date tested: | October 10 – November 30, 2011 and January 10, 2012 | | |
| FCC Rule Parts | Freq. Range [MHz] | Highest 1-g SAR (W/kg) | Limit (W/kg) |
| 22H | 824-849 | 1.19 W/kg (Body_ Rear w/ 0 mm distance) | 1.6 |
| 24E | 1850-1910 | 1.18 W/kg (Body_ Rear w/ 0 mm distance) | |
| 27 (LTE Band 13) | 777-787 | 1.19 W/kg (Body_ Rear w/ 0 mm distance) | |
| 15.247 | 2412-2462 | 1.19 W/kg (Body_ Bottom w/ 0 mm distance) | |
| | 5725-5850 | 1.15 W/kg (Body_ Bottom w/ 0 mm distance) | |
| 15.407 | 5150-5250 | 0.50 W/kg (Body_ Bottom w/ 0 mm distance) | |
| | 5250-5350 | 1.12 W/kg (Body_ Bottom w/ 0 mm distance) | |
| | 5500-5700 | 1.08 W/kg (Body_ Bottom w/ 0 mm distance) | |
| Applicable Standards | | | Test Results |
| FCC OET Bulletin 65 Supplement C 01-01, IEEE 1528:2003, RSS-102 Issue 4, March 2010 and IEC 62209-2:2010 | | | 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

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

Tested By:

Devin Chang

Devin Chang
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, IEC 62209-2:2010 and the following KDB Test Procedures.

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

Testing is performed per FCC's guidance KDB # 303789.

## 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 | | |
| Synthesized Signal Generator | HP | 83732B | US34490599 | 7 | 14 | 2012 |
| E-Field Probe | SPEAG | EX3DV4 | 3749 | 12 | 13 | 2011 |
| E-Field Probe | SPEAG | EX3DV4 | 3686 | 1 | 24 | 2012 |
| Thermometer | ERTCO | 639-1S | 1718 | 7 | 19 | 2012 |
| Data Acquisition Electronics | SPEAG | DAE3 | 500 | 7 | 14 | 2012 |
| Data Acquisition Electronics | SPEAG | DAE4 | 1259 | 5 | 3 | 2012 |
| System Validation Dipole | SPEAG | D750V3 | 1019 | 12 | 16 | 2011 |
| System Validation Dipole | SPEAG | D835V2 | 4d117 | 4 | 15 | 2012 |
| System Validation Dipole | SPEAG | D1900V2 | 5d140 | 4 | 18 | 2012 |
| System Validation Dipole | SPEAG | *D2450V2 | 706 | 4 | 19 | 2012 |
| System Validation Dipole | SPEAG | D5GHzV2 | 1003 | 8 | 23 | 2012 |
| Power Meter | HP | 437B | 3125U16345 | 5 | 13 | 2012 |
| Power Sensor | HP | 8481A | 2702A60780 | 5 | 13 | 2012 |
| Radio Communication Tester | R&S | CMU200 | 838114/032 | 3 | 1 | 2012 |
| Radio Communication Tester | R&S | CMW500 | 20-316567 | 12 | 17 | 2011 |
| Amplifier | MITEQ | 4D00400600-50-30P | 1620606 | N/A | | |
| Directional coupler | Werlatone | C8060-102 | 2141 | N/A | | |

**Notes:**

*Per KDB 450824 D02 requirements for dipole calibration, UL CCS has adopted two years calibration intervals. On annual basis, each measurement dipole has been evaluated and is in compliance with the following criteria:

1. There is no physical damage on the dipole
2. System validation with specific dipole is within 10% of calibrated value.
3. Return-loss is within 20% of calibrated measurement. (See Appendix “18.16_Calibration Certificate - Validation Dipole D2450V2 - SN 706” with extended cal. data)
4. Impedance is within 5Ω of calibrated measurement (See Appendix “18.16_Calibration Certificate - Validation Dipole D2450V2 - SN 706” with extended cal. data)

## 4.2. Measurement Uncertainty

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

| Component | error, % | Probe Distribution | Divisor | Sensitivity | U (Xi), % |
|---|---|---|---|---|---|
| **Measurement System** | | | | | |
| Probe Calibration (k=1) | 5.50 | Normal | 1 | 1 | 5.50 |
| Axial Isotropy | 1.15 | Rectangular | 1.732 | 0.7071 | 0.47 |
| Hemispherical Isotropy | 2.30 | Rectangular | 1.732 | 0.7071 | 0.94 |
| Boundary Effect | 0.90 | Rectangular | 1.732 | 1 | 0.52 |
| Probe Linearity | 3.45 | Rectangular | 1.732 | 1 | 1.99 |
| System Detection Limits | 1.00 | Rectangular | 1.732 | 1 | 0.58 |
| Readout Electronics | 0.30 | Normal | 1 | 1 | 0.30 |
| Response Time | 0.80 | Rectangular | 1.732 | 1 | 0.46 |
| Integration Time | 2.60 | Rectangular | 1.732 | 1 | 1.50 |
| RF Ambient Conditions - Noise | 3.00 | Rectangular | 1.732 | 1 | 1.73 |
| RF Ambient Conditions - Reflections | 3.00 | Rectangular | 1.732 | 1 | 1.73 |
| Probe Positioner Mechanical Tolerance | 0.40 | Rectangular | 1.732 | 1 | 0.23 |
| Probe Positioning with respect to Phantom | 2.90 | Rectangular | 1.732 | 1 | 1.67 |
| Extrapolation, Interpolation and Integration | 1.00 | Rectangular | 1.732 | 1 | 0.58 |
| **Test Sample Related** | | | | | |
| Test Sample Positioning | 2.90 | Normal | 1 | 1 | 2.90 |
| Device Holder Uncertainty | 3.60 | Normal | 1 | 1 | 3.60 |
| Output Power Variation - SAR Drift | 5.00 | Rectangular | 1.732 | 1 | 2.89 |
| **Phantom and Tissue Parameters** | | | | | |
| Phantom Uncertainty (shape and thickness) | 4.00 | Rectangular | 1.732 | 1 | 2.31 |
| Liquid Conductivity - deviation from target | 5.00 | Rectangular | 1.732 | 0.64 | 1.85 |
| Liquid Conductivity - measurement | -4.92 | Normal | 1 | 0.64 | -3.15 |
| Liquid Permittivity - deviation from target | 5.00 | Rectangular | 1.732 | 0.6 | 1.73 |
| Liquid Permittivity - measurement uncertainty | -4.13 | Normal | 1 | 0.6 | -2.48 |
| | | | | Combined Standard Uncertainty Uc(y) = | 10.26 |
| | | | | Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence = 20.51 | % |
| | | | | Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence = 1.62 | dB |

Measurement uncertainty for 3 to 6 GHz averaged over 1 gram

| Component | error, % | Distribution | Divisor | Sensitivity | U (Xi), % |
|---|---|---|---|---|---|
| **Measurement System** | | | | | |
| Probe Calibration (k=1) | 6.55 | Normal | 1 | 1 | 6.55 |
| Axial Isotropy | 1.15 | Rectangular | 1.732 | 0.7071 | 0.47 |
| Hemispherical Isotropy | 2.30 | Rectangular | 1.732 | 0.7071 | 0.94 |
| Boundary Effect | 0.90 | Rectangular | 1.732 | 1 | 0.52 |
| Probe Linearity | 3.45 | Rectangular | 1.732 | 1 | 1.99 |
| System Detection Limits | 1.00 | Rectangular | 1.732 | 1 | 0.58 |
| Readout Electronics | 1.00 | Normal | 1 | 1 | 1.00 |
| Response Time | 0.80 | Rectangular | 1.732 | 1 | 0.46 |
| Integration Time | 2.60 | Rectangular | 1.732 | 1 | 1.50 |
| RF Ambient Conditions - Noise | 3.00 | Rectangular | 1.732 | 1 | 1.73 |
| RF Ambient Conditions - Reflections | 3.00 | Rectangular | 1.732 | 1 | 1.73 |
| Probe Positioner Mechanical Tolerance | 0.40 | Rectangular | 1.732 | 1 | 0.23 |
| Probe Positioning with respect to Phantom | 2.90 | Rectangular | 1.732 | 1 | 1.67 |
| Extrapolation, Interpolation and Integration | 3.90 | Rectangular | 1.732 | 1 | 2.25 |
| **Test Sample Related** | | | | | |
| Test Sample Positioning | 1.10 | Normal | 1 | 1 | 1.10 |
| Device Holder Uncertainty | 3.60 | Normal | 1 | 1 | 3.60 |
| Output Power Variation - SAR Drift | 5.00 | Rectangular | 1.732 | 1 | 2.89 |
| **Phantom and Tissue Parameters** | | | | | |
| Phantom Uncertainty (shape and thickness) | 4.00 | Rectangular | 1.732 | 1 | 2.31 |
| Liquid Conductivity - deviation from target | 5.00 | Rectangular | 1.732 | 0.64 | 1.85 |
| Liquid Conductivity - measurement | 4.80 | Normal | 1 | 0.64 | 3.07 |
| Liquid Permittivity - deviation from target | 10.00 | Rectangular | 1.732 | 0.6 | 3.46 |
| Liquid Permittivity - measurement uncertainty | -4.44 | Normal | 1 | 0.6 | -2.66 |
| | | | | Combined Standard Uncertainty Uc(y), %: | 11.21 |
| | | | | Expanded Uncertainty U, Coverage Factor = 1.96, > 95 % Confidence = 21.98 | % |
| | | | | Expanded Uncertainty U, Coverage Factor = 1.96, > 95 % Confidence = 1.73 | dB |

# 5. Equipment Under Test

| | |
|---|---|
| The Apple iPad, Model A1403 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 CDMA/GSM 2G/3G/LTE data radio functions<br>Model: A1403 | |
| Normal operation: | Body and Wireless Router (Hotspot) |
| Antenna-to-antenna and antenna-to-edges' separation distances: | Please refer to Section 19 Antenna Locations & Separation Distances |
| Proximity Sensor for Power Reduction: | There is no proximity sensor for power reduction for WiFi/BT Antenna.<br>The proximity sensor for power reduction is applied to Primary Cellular Antenna only.<br>Trigger Distance:<br>o 0-11 mm from Rear,<br>o 0-14 mm from Top-edge of device. |
| Simultaneous Transmission: | • WWAN Radio (CDMA/EVDO/GPRS/EGPRS/UMTS/LTE) can transmit simultaneously with WiFi/BT Radio.<br>• WiFi 2.4GHz Radio cannot transmit simultaneously with Bluetooth Radio.<br>• WiFi 5GHz Radio can transmit simultaneously with Bluetooth Radio.<br><br>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.<br>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 13: Tx: 777 – 787 MHz; Rx: 746 – 756 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>5 MHz, 10 MHz</td></tr>
<tr><td>3</td><td>Identify the high, middle and low (H, M, L) channel numbers and frequencies in each LTE frequency band</td><td>
<table>
<tr><th rowspan="2">Band 13</th><th colspan="2">Channel Bandwidth</th></tr>
<tr><th>10 MHz</th><th>5 MHz</th></tr>
<tr><th></th><th>Ch. # / Freq. (MHz)</th><th>Ch. # / Freq. (MHz)</th></tr>
<tr><td>Low</td><td></td><td>23205 / 779.5</td></tr>
<tr><td>Mid</td><td>23230 / 782.0</td><td>23230 / 782.0</td></tr>
<tr><td>High</td><td></td><td>23255 / 784.5</td></tr>
</table>
</td></tr>
<tr><td>4</td><td>Specify the UE category and uplink modulations used</td><td>UE Category: 3<br>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 (CDMA/EVDO/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.<br>Exposure Conditions:<br>○ Body – Rear, Bottom, Left-edge, Top-edge, and Right-edge of the DUT at a separation distance of 0 cm from the flat phantom.<br>○ With Proximity Sensor Power back-off disabled<br>○ Rear of the DUT at the separation distance of 11 mm to the flat phantom.<br>○ Top-edge of the DUT at the separation distance of 14 mm to the flat phantom.<br>○ 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<br>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.<br>A-MPR is supported by design, but is disabled for SAR testing.<br>A-MPR is disabled, by using Network Setting value of NS_01.</td></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:<br>a) with 1 RB allocated at the upper edge of a channel<br>b) with 1 RB allocated at the lower edge of a channel<br>c) using 50% RB allocation centered within a channel<br>d) using 100% RB allocation</td><td>Refer to section 7.4</td></tr>
</table>

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 rowspan="15">9</td><td rowspan="15">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>CDMA 1xRTT</td><td>QPSK</td></tr>
<tr><td>EVDO Rev. 0, Rev. A</td><td>QPSK</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.<br>Exposure Conditions:<br>○ Body – Rear, Bottom, Left-edge, Top-edge, and Right-edge of the DUT at a separation distance of 0 cm from the flat phantom.<br>○ With Proximity Sensor Power back-off disabled<br>○ Rear surface of the DUT at the separation distance of 11 mm to the flat phantom.<br>○ Top-edge of the DUT at the separation distance of 14 mm to the flat phantom.<br>○ Top-edge/Right Corner of the DUT at the separation angle of 15 degrees to the flat phantom</td></tr>
<tr><td>10</td><td>Include the maximum average conducted output power measured for the other wireless mode and frequency bands</td><td colspan="2">Refer to section 7.1, 7.2, 7.3, 7.5 and 7.6</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 (CDMA/EVDO/GPRS/EGPRS/UMTS/ LTE) can transmit simultaneously with WiFi/BT Radio.<br>• WiFi 2.4GHz Radio cannot transmit simultaneously with Bluetooth Radio.<br>• WiFi 5GHz Radio can transmit simultaneously with Bluetooth Radio.</td></tr>
<tr><td>12</td><td>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</td><td colspan="2">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.</td></tr>
</table>

KDB 941225 D05 SAR for LTE Devices v01 (Continued)

| Item | Description | Information |
|---|---|---|
| 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 303789 |
| 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 | 777 – 787 MHz, 824 – 849 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 |

## 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 | CDMA 1xRTT | 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] | 782 | Yes | No | No | No | No | No | No | No | Yes | No | No |
| | | | CDMA 1xRTT [b1] | 835 | No | Yes | No | No | No | No | No | No | | No | No |
| | | | CDMA 1xRTT [b1] | 1900 | No | Yes | No | No | No | No | No | No | | No | No |
| | | | GPRS [c1] | 850 | No | No | Yes | No | No | No | No | No | | No | No |
| | | | GPRS [c1] | 1900 | No | No | Yes | No | No | No | No | No | | No | No |
| | | | WCDMA [d1] | 835 | No | No | No | Yes | No | No | No | No | | No | No |
| | | | WCDMA [d1] | 1900 | No | No | No | Yes | No | No | No | No | | No | No |
| | | | HSDPA [e1] | 835 | No | No | No | No | Yes | No | No | No | | No | No |
| | | | HSDPA [e1] | 1900 | No | No | No | No | Yes | No | No | No | | No | No |
| | | | HSUPA [f1] | 835 | No | No | No | No | No | Yes | No | No | | No | No |
| | | | HSUPA [f1] | 1900 | No | No | No | No | No | Yes | No | No | | No | No |
| | | | HSPA+ [g1] | 835 | No | No | No | No | No | No | Yes | No | | No | No |
| | | | HSPA+ [g1] | 1900 | No | No | No | No | No | No | Yes | No | | No | No |
| | | | DC-HSDPA [h1] | 835 | No | No | No | No | No | No | No | Yes | | No | No |
| | | | DC-HSDPA [h1] | 1900 | No | No | No | No | No | No | No | Yes | | No | No |
| | | Cellular + 5.0GHz WiFi | LTE [a1] | 782 | Yes | No | No | No | No | No | No | No | No | | No |
| | | | CDMA 1xRTT [b1] | 835 | No | Yes | No | No | No | No | No | No | No | | |
| | | | CDMA 1xRTT [b1] | 1900 | No | Yes | No | No | No | No | No | No | No | | No |
| | | | GPRS [c1] | 850 | No | No | Yes | No | No | No | No | No | No | | No |
| | | | GPRS [c1] | 1900 | No | No | Yes | No | No | No | No | No | No | | No |
| | | | WCDMA [d1] | 835 | No | No | No | Yes | No | No | No | No | No | | No |
| | | | WCDMA [d1] | 1900 | No | No | No | Yes | No | No | No | No | No | | No |
| | | | HSDPA [e1] | 835 | No | No | No | No | Yes | No | No | No | No | Yes | No |
| | | | HSDPA [e1] | 1900 | No | No | No | No | Yes | No | No | No | No | | No |
| | | | HSUPA [f1] | 835 | No | No | No | No | No | Yes | No | No | No | | No |
| | | | HSUPA [f1] | 1900 | No | No | No | No | No | Yes | No | No | No | | No |
| | | | HSPA+ [g1] | 835 | No | No | No | No | No | No | Yes | No | No | | No |
| | | | HSPA+ [g1] | 1900 | No | No | No | No | No | No | Yes | No | No | | No |
| | | | DC-HSDPA [h1] | 835 | No | No | No | No | No | No | No | Yes | No | | No |
| | | | DC-HSDPA [h1] | 1900 | No | 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 | CDMA 1xRTT | 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] | 782 | Yes | No | No | No | No | No | No | No | No | No | Yes |
| | | | CDMA 1xRTT[b1] | 835 | No | Yes | No | No | No | No | No | No | No | No | |
| | | | CDMA 1xRTT[b1] | 1900 | No | Yes | No | No | No | No | No | No | No | No | |
| | | | GPRS[c1] | 850 | No | No | Yes | No | No | No | No | No | No | No | |
| | | | GPRS[c1] | 1900 | No | No | Yes | No | No | No | No | No | No | No | |
| | | | WCDMA[d1] | 835 | No | No | No | Yes | No | No | No | No | No | No | |
| | | | WCDMA[d1] | 1900 | No | No | No | Yes | No | No | No | No | No | No | |
| | | | HSDPA[e1] | 835 | No | No | No | No | Yes | No | No | No | No | No | |
| | | | HSDPA[e1] | 1900 | No | No | No | No | Yes | No | No | No | No | No | |
| | | | HSUPA[f1] | 835 | No | No | No | No | No | Yes | No | No | No | No | |
| | | | HSUPA[f1] | 1900 | No | No | No | No | No | Yes | No | No | No | No | |
| | | | HSPA+[g1] | 835 | No | No | No | No | No | No | Yes | No | No | No | |
| | | | HSPA+[g1] | 1900 | No | No | No | No | No | No | Yes | No | No | No | |
| | | | DC-HSDPA[h1] | 835 | No | No | No | No | No | No | No | Yes | No | No | |
| | | | DC-HSDPA[h1] | 1900 | No | No | No | No | No | No | No | Yes | No | No | |
| | | Cellular + 5.0GHz WiFi + Bluetooth | LTE[a1] | 782 | Yes | No | No | No | No | No | No | No | No | | Yes |
| | | | CDMA 1xRTT[b1] | 835 | No | Yes | No | No | No | No | No | No | No | | |
| | | | CDMA 1xRTT[b1] | 1900 | No | Yes | No | No | No | No | No | No | No | | |
| | | | GPRS[c1] | 850 | No | No | Yes | No | No | No | No | No | No | | |
| | | | GPRS[c1] | 1900 | No | No | Yes | No | No | No | No | No | No | | |
| | | | WCDMA[d1] | 835 | No | No | No | Yes | No | No | No | No | No | | |
| | | | WCDMA[d1] | 1900 | No | No | No | Yes | No | No | No | No | No | | |
| | | | HSDPA[e1] | 835 | No | No | No | No | Yes | No | No | No | No | Yes | |
| | | | HSDPA[e1] | 1900 | No | No | No | No | Yes | No | No | No | No | | |
| | | | HSUPA[f1] | 835 | No | No | No | No | No | Yes | No | No | No | | |
| | | | HSUPA[f1] | 1900 | No | No | No | No | No | Yes | No | No | No | | |
| | | | HSPA+[g1] | 835 | No | No | No | No | No | No | Yes | No | No | | |
| | | | HSPA+[g1] | 1900 | No | No | No | No | No | No | Yes | No | No | | |
| | | | DC-HSDPA[h1] | 835 | No | No | No | No | No | No | No | Yes | No | | |
| | | | DC-HSDPA[h1] | 1900 | No | 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. See test results in section 7.4.
- 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. See conducted power results in section 7.4. Additionally, the SAR for 10 MHz channel bandwidth for all RB configurations is less than 1.45 W/kg. See test results in section 13.7.

b1 – Per KDB941225 D01 SAR test for 3G devices v02, Body SAR evaluation for Primary antenna is performed in RC3/SO32 only.

- Body SAR for multiple code channel (FCH+SCH) is not required since the output power is not ¼ dB higher than RC3/SO32. Also, see conducted power results in section 7.3.

c1 – Per KDB 941225 D03 SAR Test Reduction GSM/GPRS/EDGE vo1,

- Refer to conducted power results in section 7.1.

d1 – 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". Also, see conducted power results in section 7.2.

e1 – 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. Also, see conducted power results in section 7.2.

f1 – 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. Also, see conducted power results in section 7.2.

g1 –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 f1.

h1 – 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.

i1 – 5.0 GHz WiFi can transmit simultaneously with Bluetooth.

# 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 A1403, 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 |

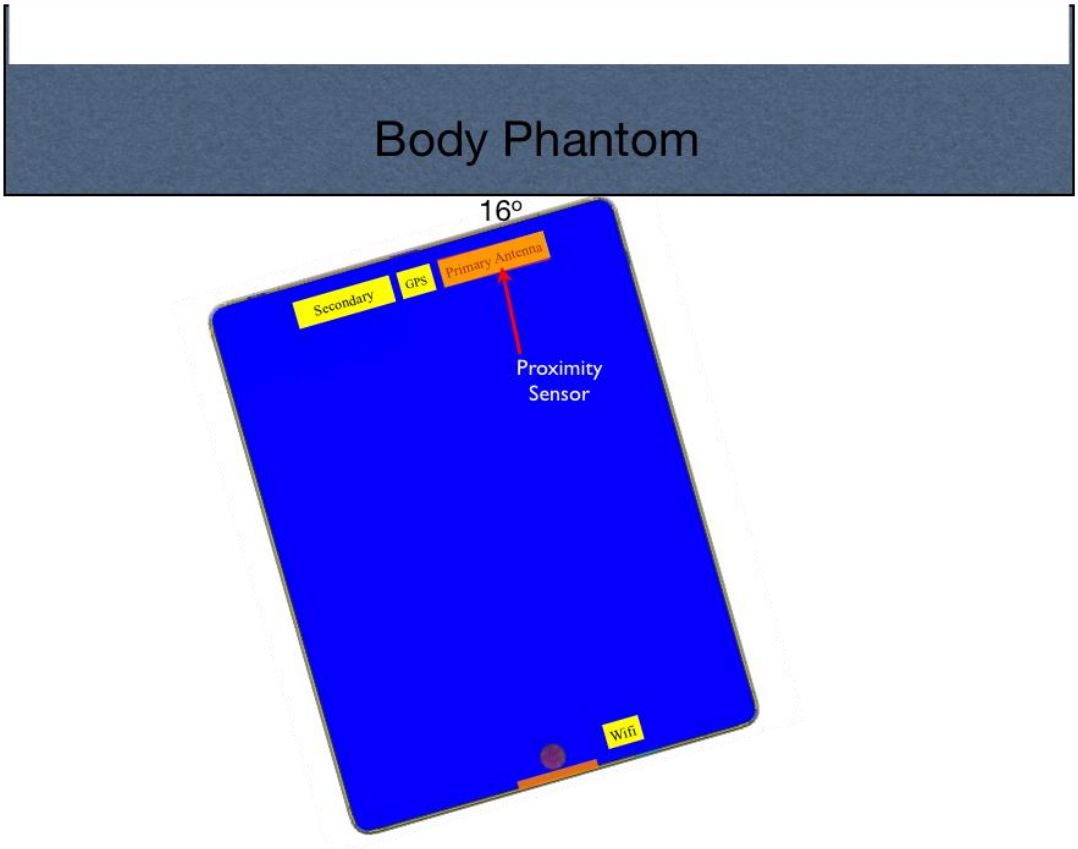
Since the primary antenna is 35.1mm from the edge of the device, additional testing is performed to evaluate the coverage of the proximity sensor detection area.

## 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) SAR evaluations, 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.

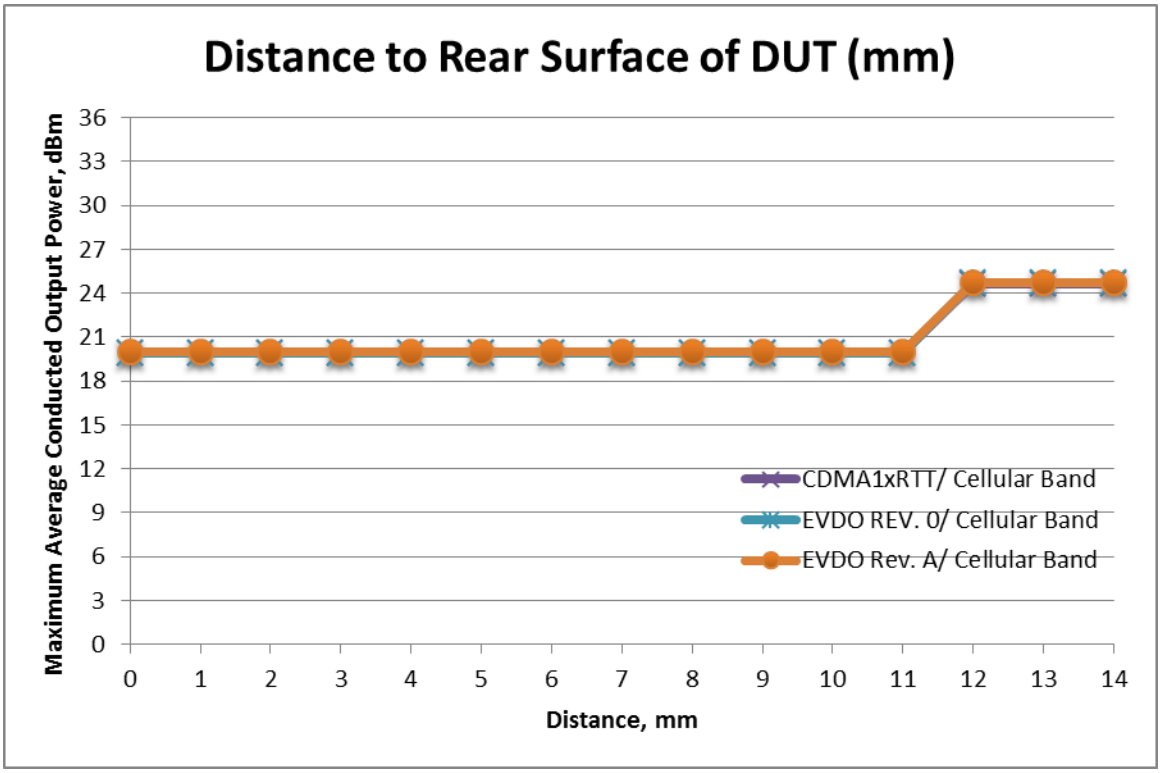
## 6.6. Power Reduction Values

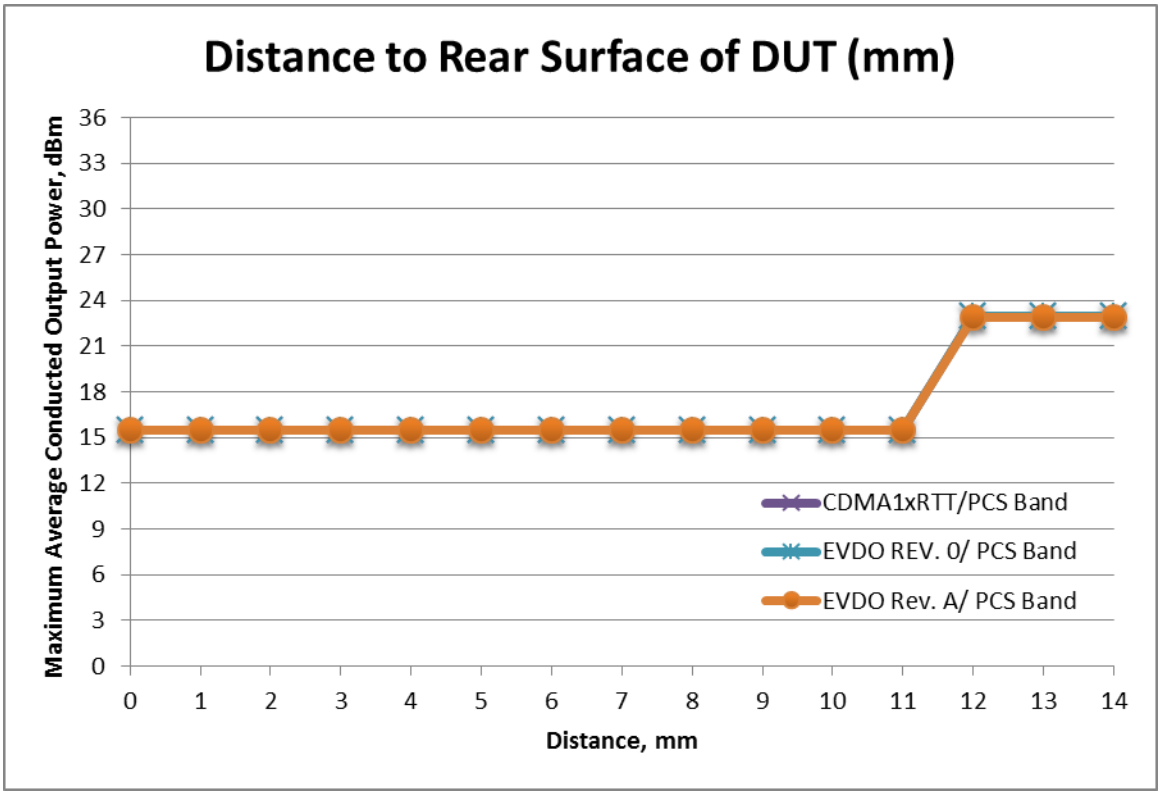
The measured power reduction in each air-interface is listed below. The power reduction values are same for Top-edge, Front and Rear.

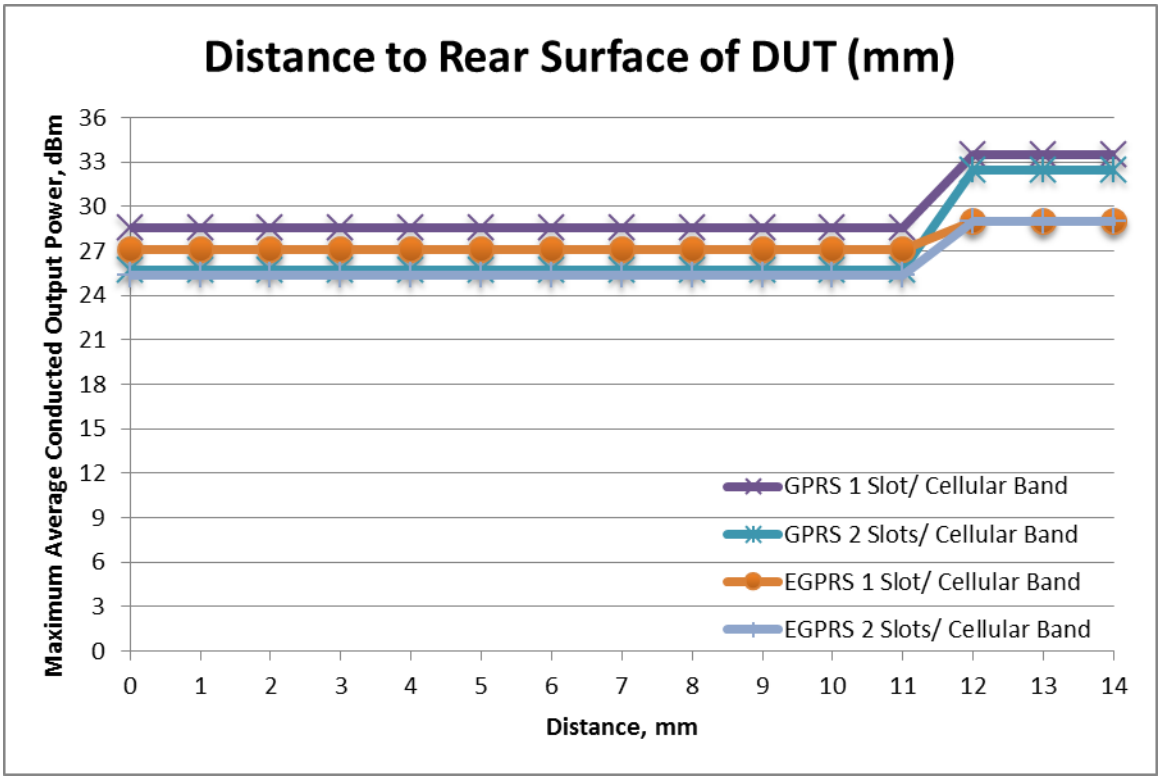
The following tables show the power vs distance plots for

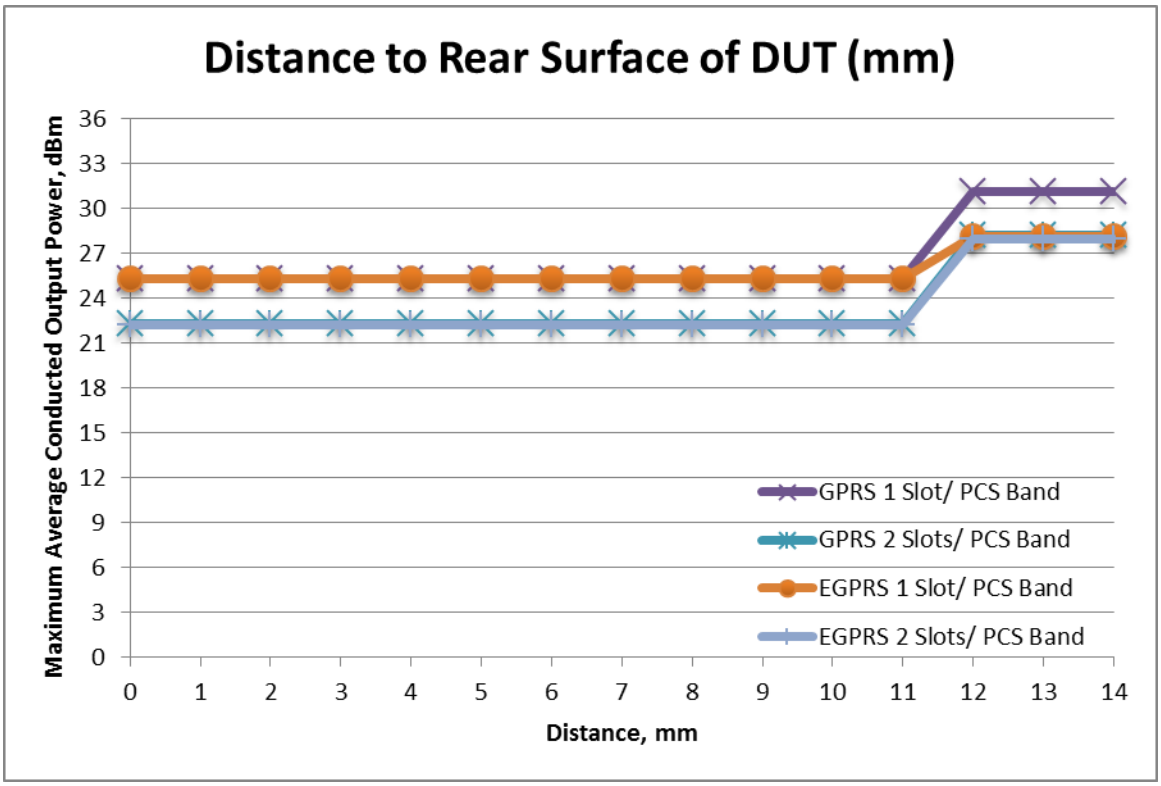
- Rear
- Top Edge

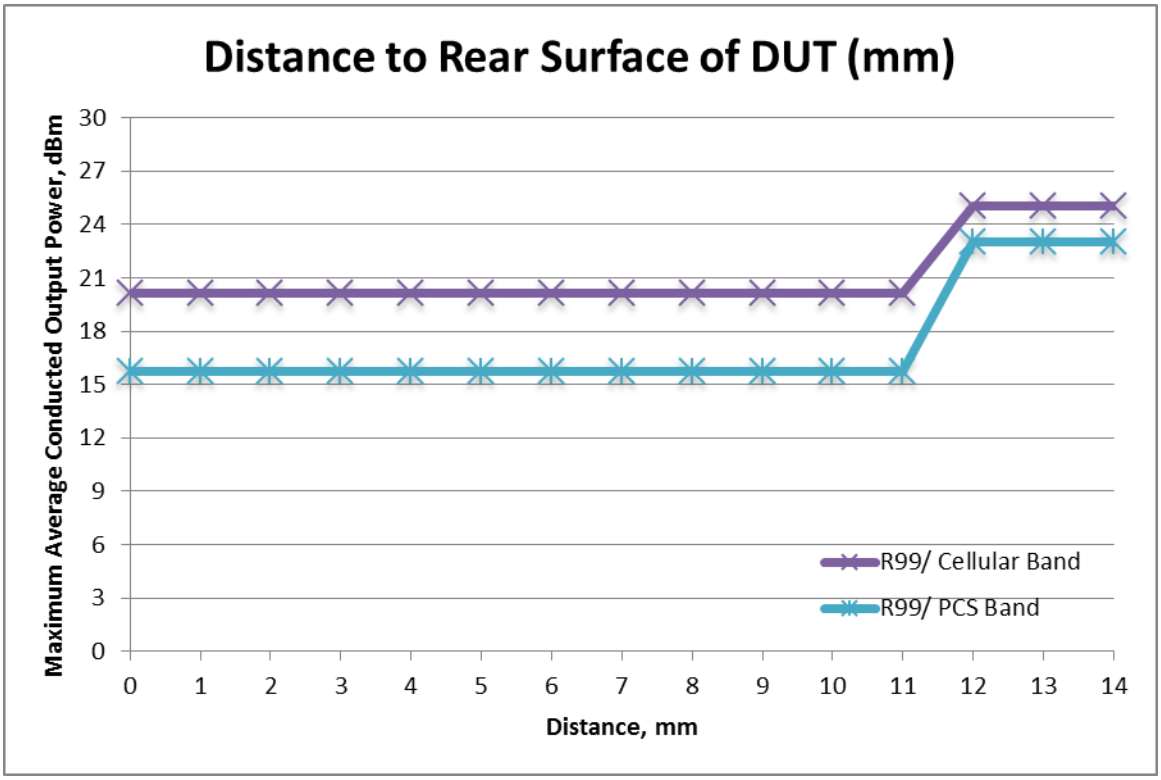
of the DUT with the proximity sensor enabled.

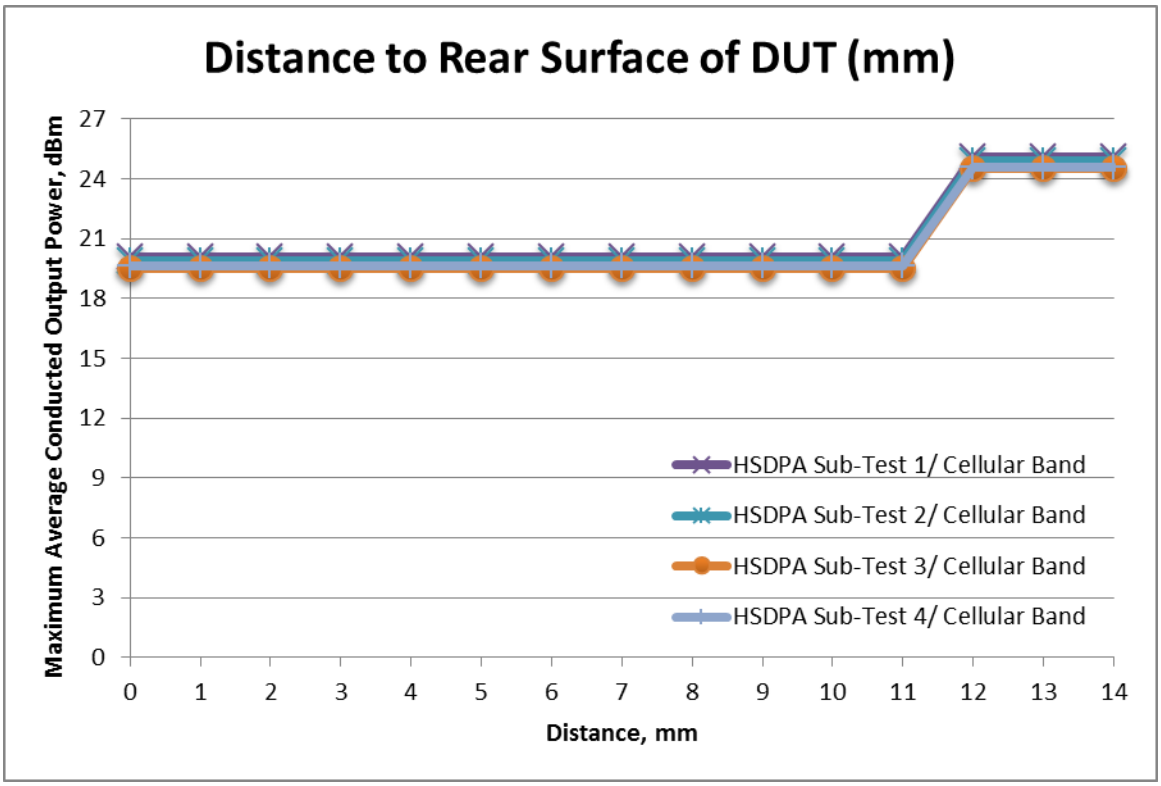


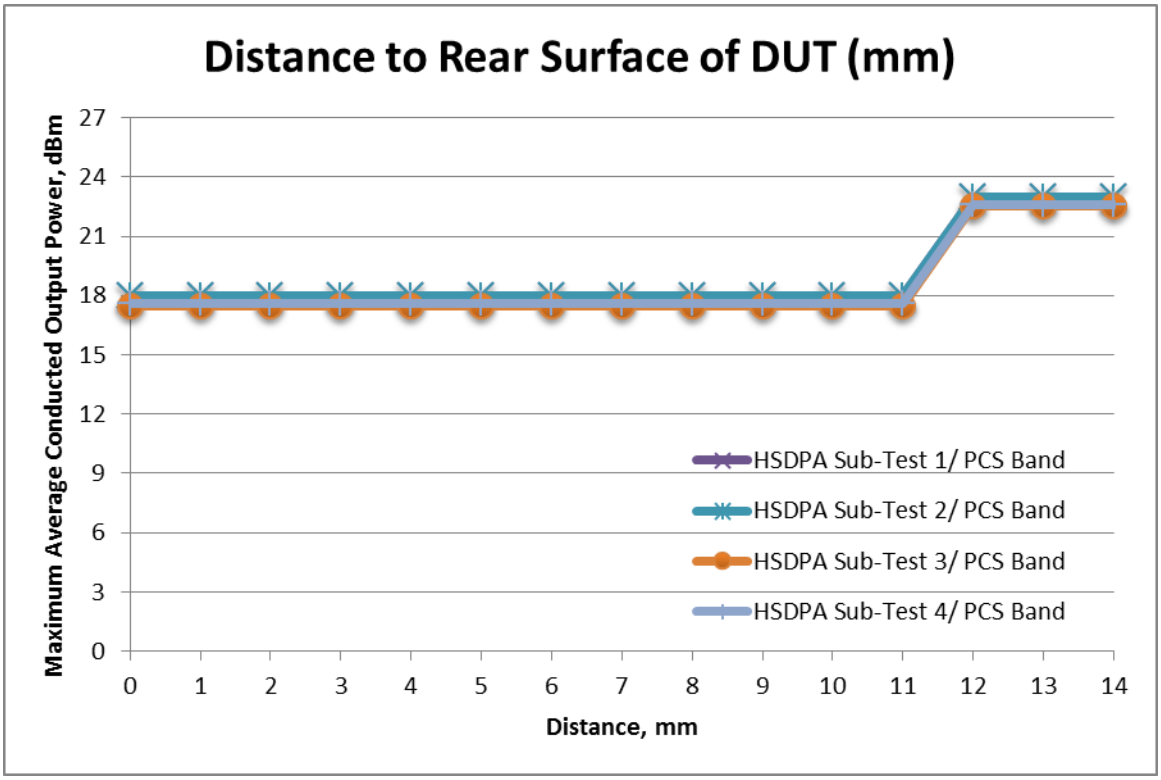



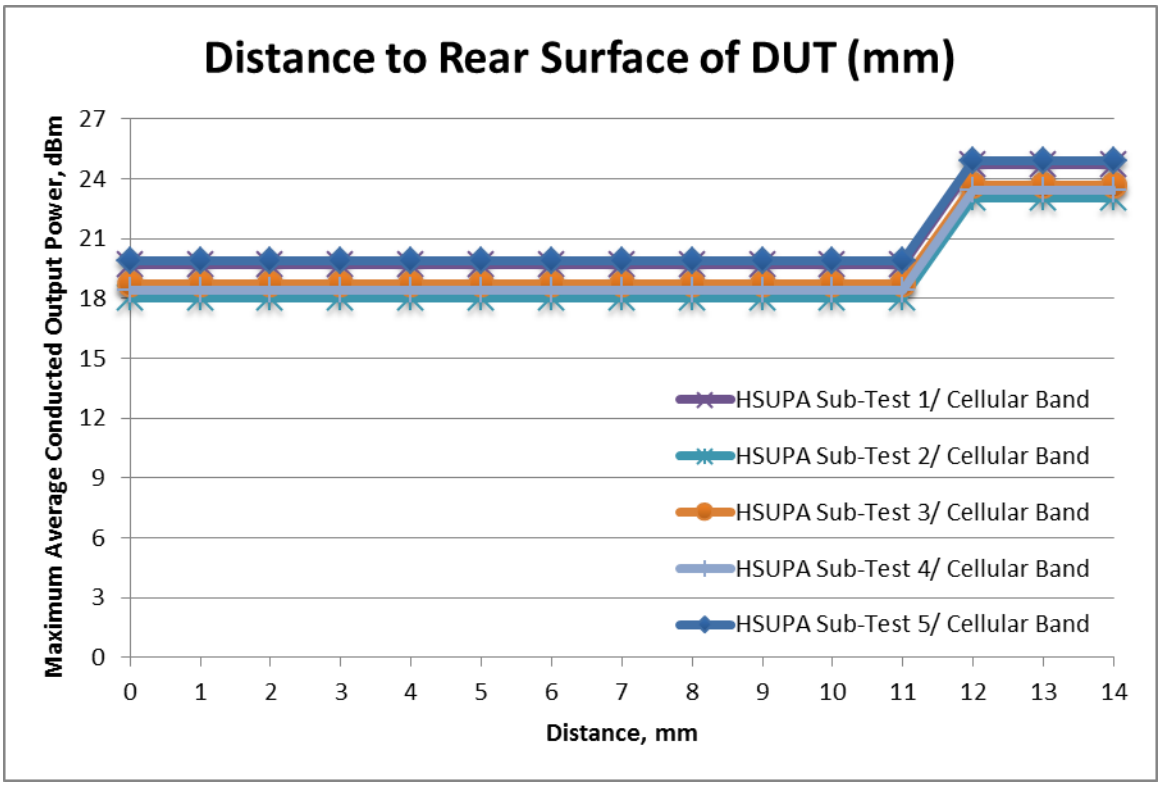


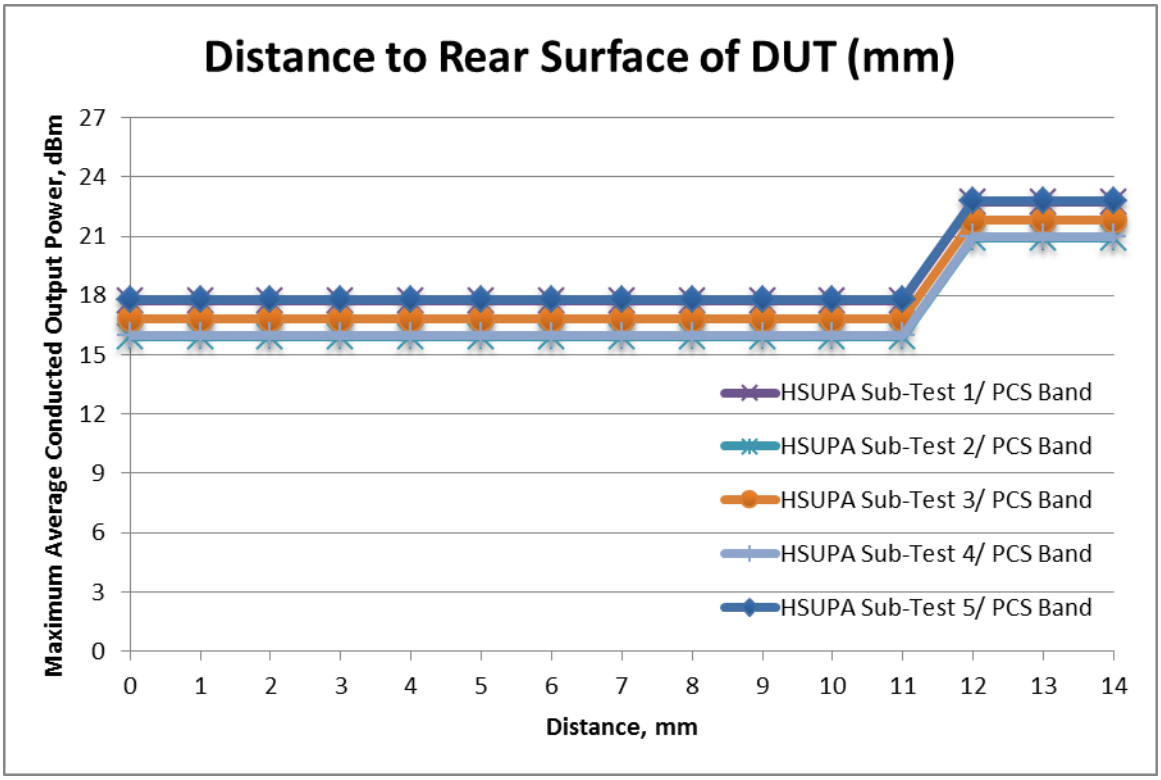



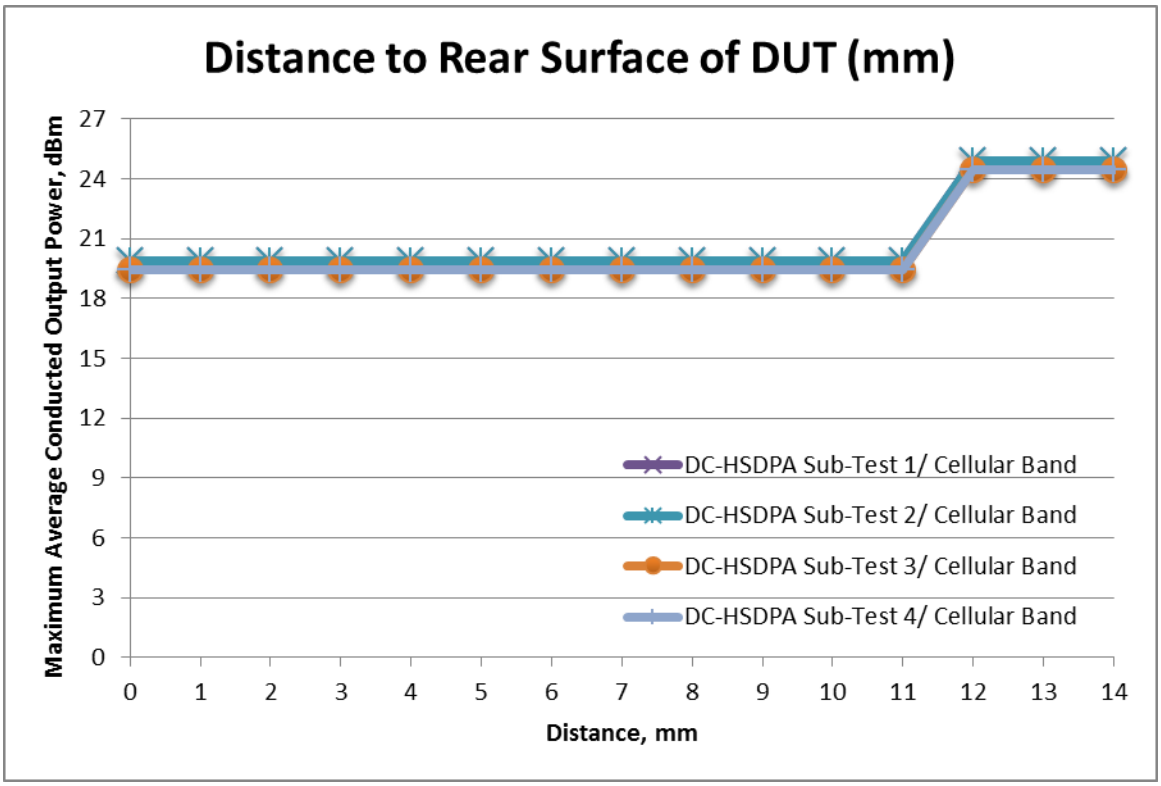


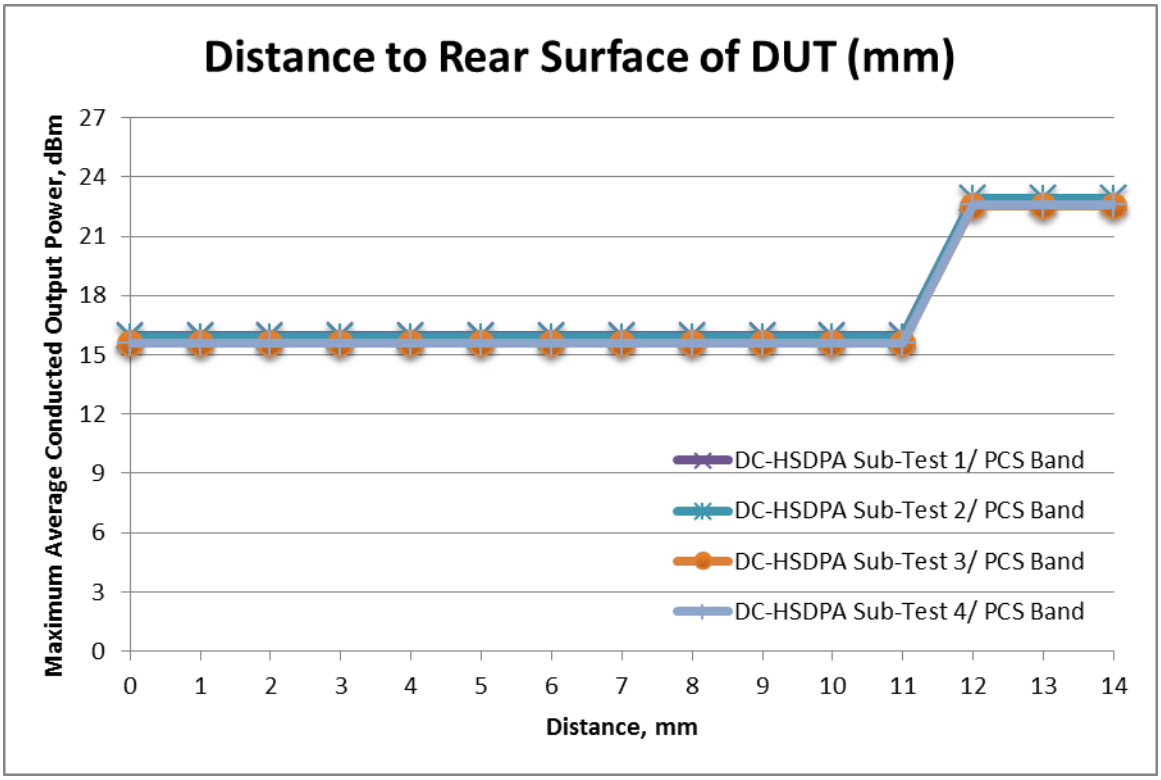



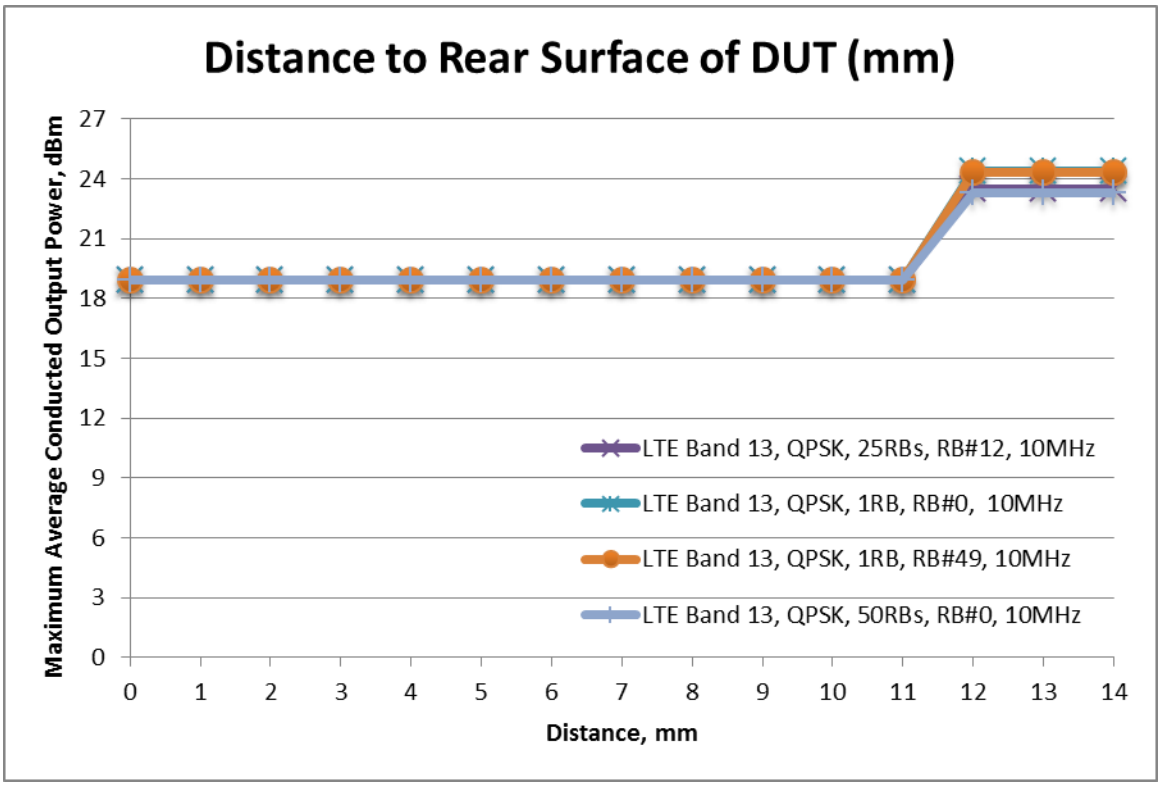


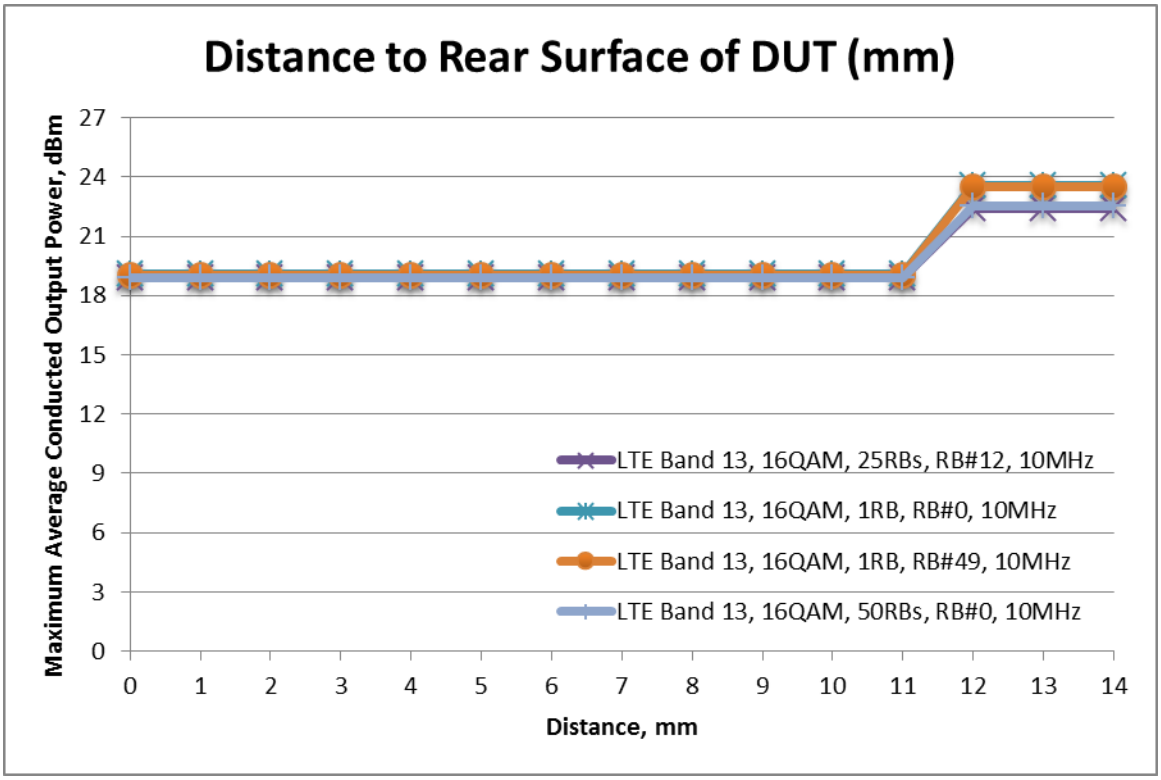



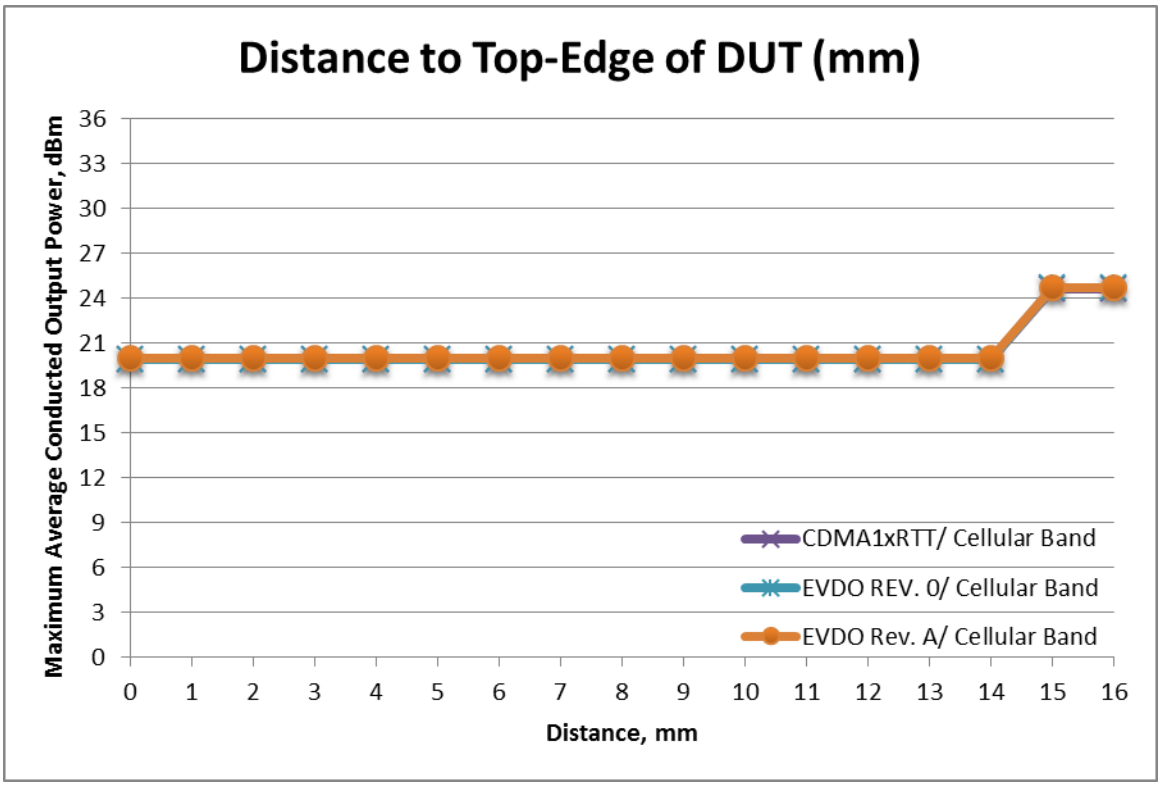


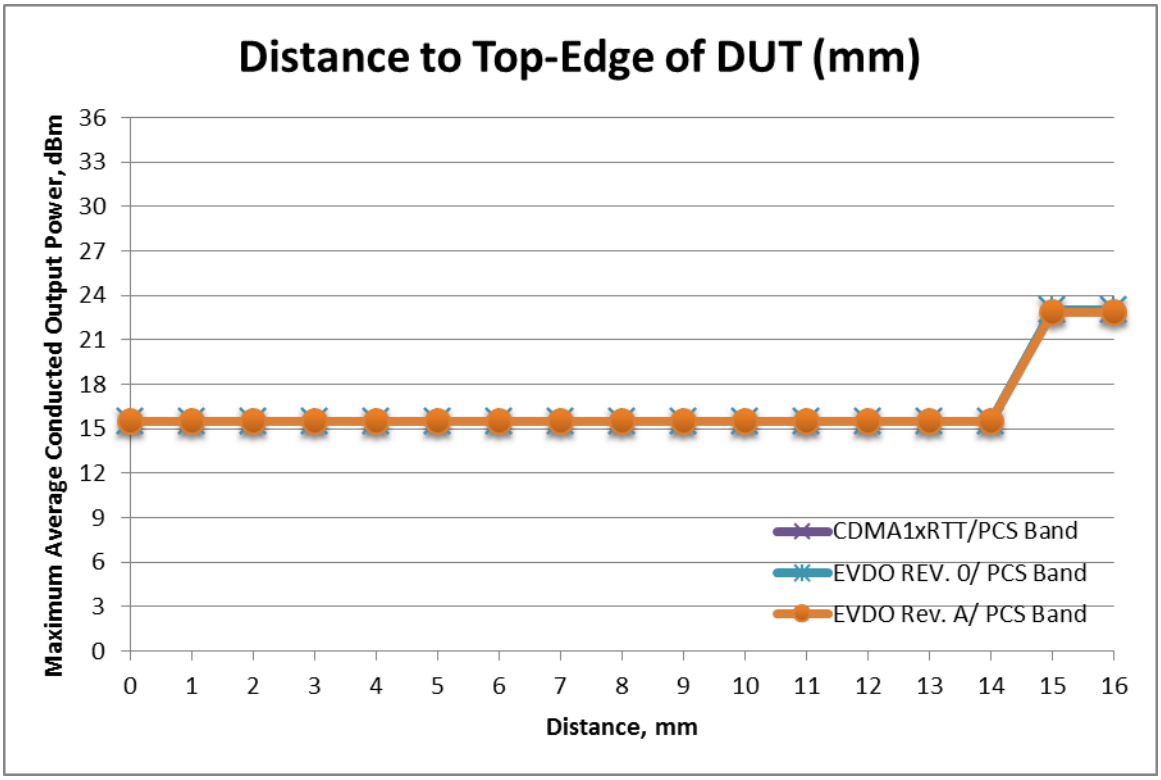



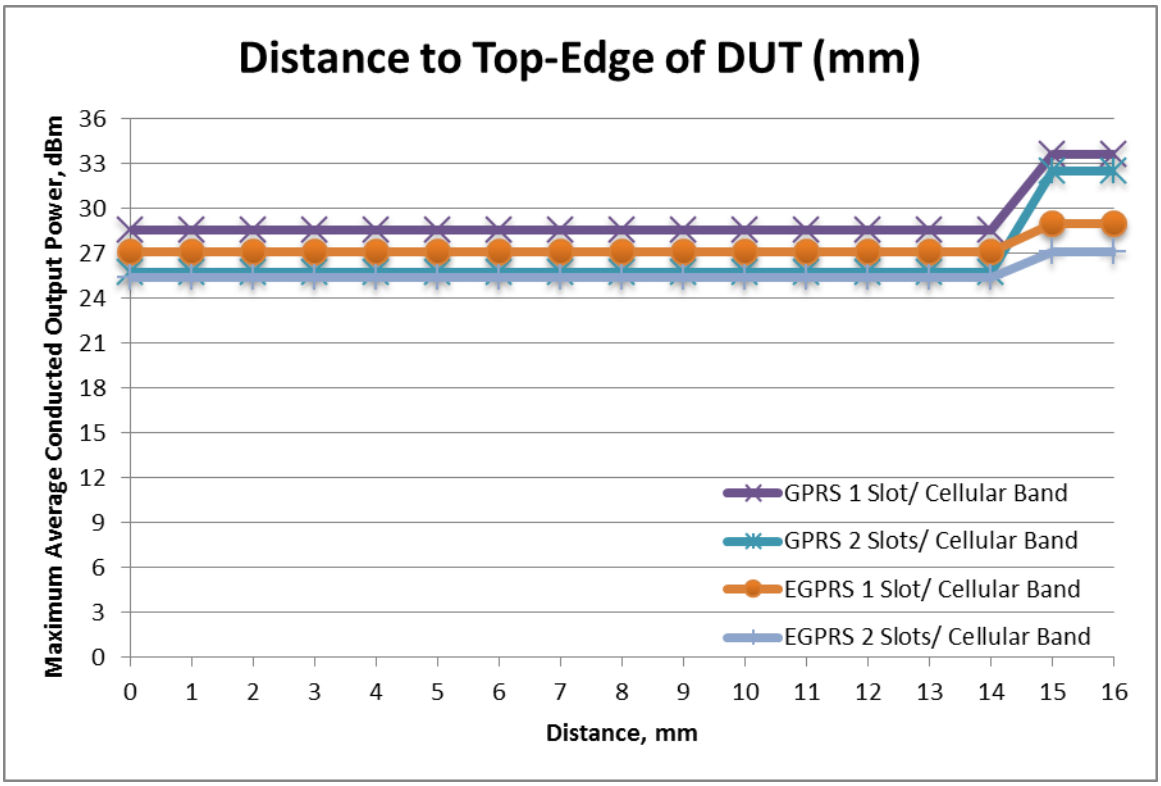


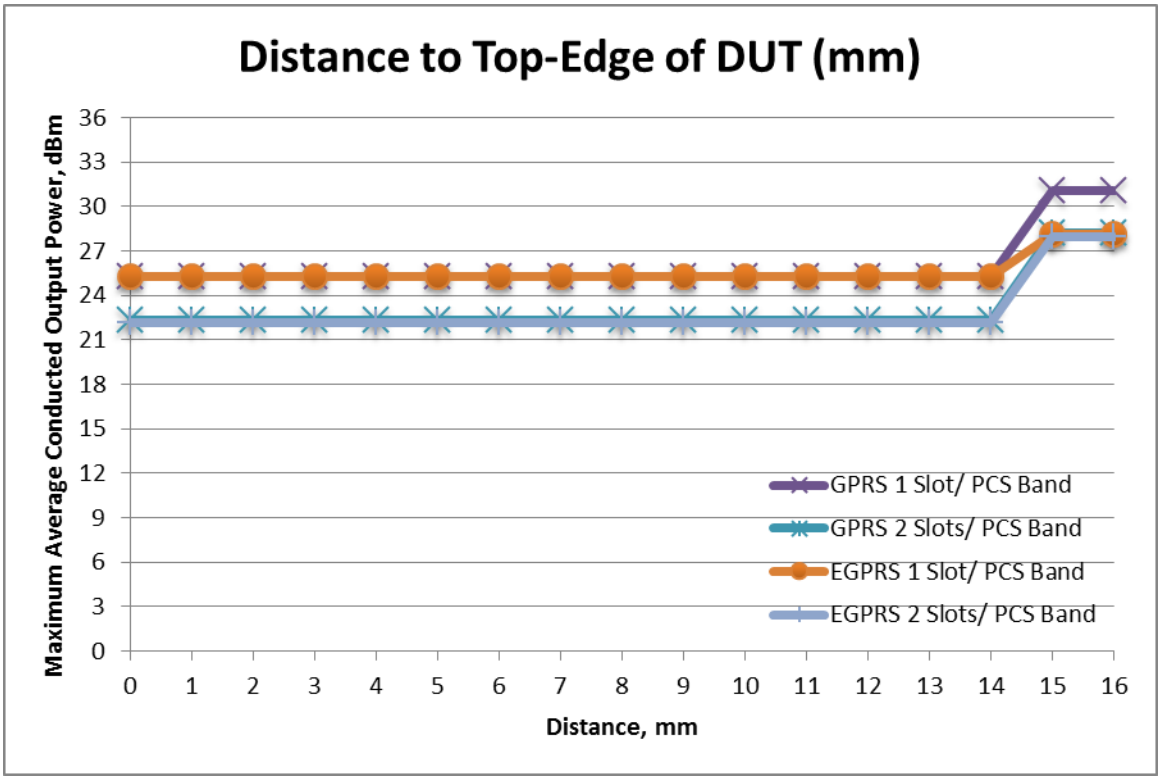



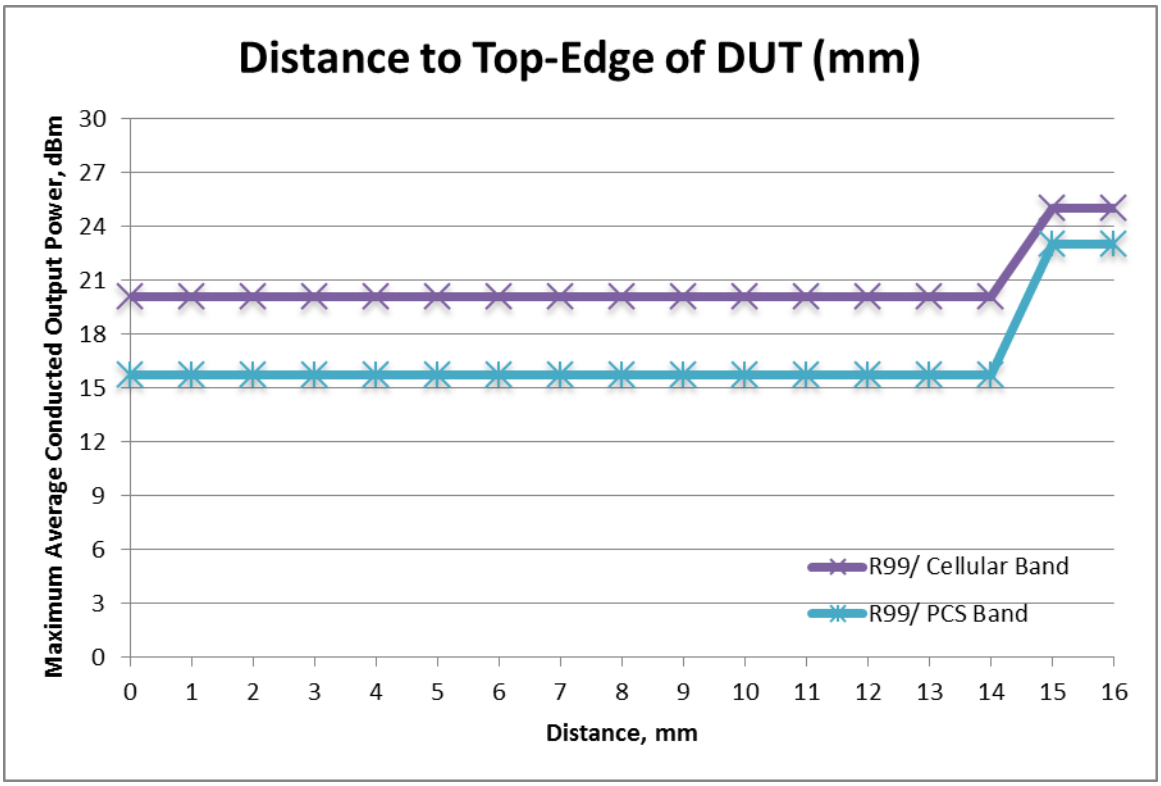


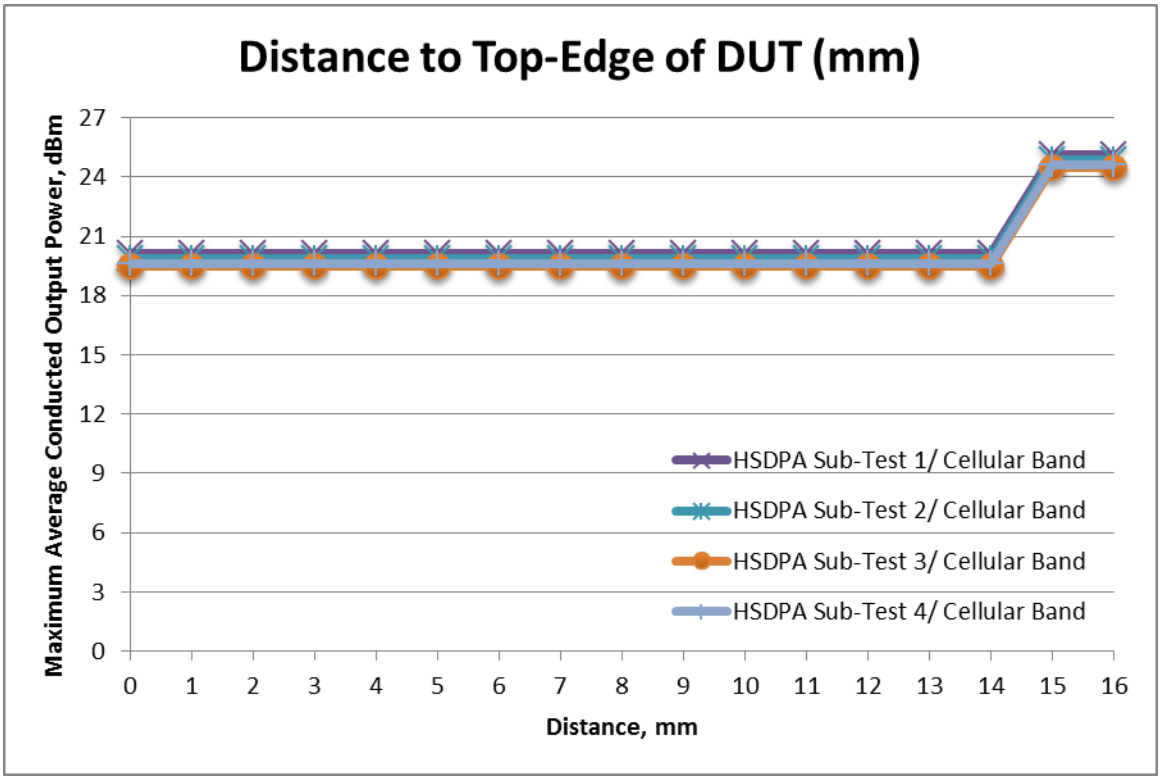



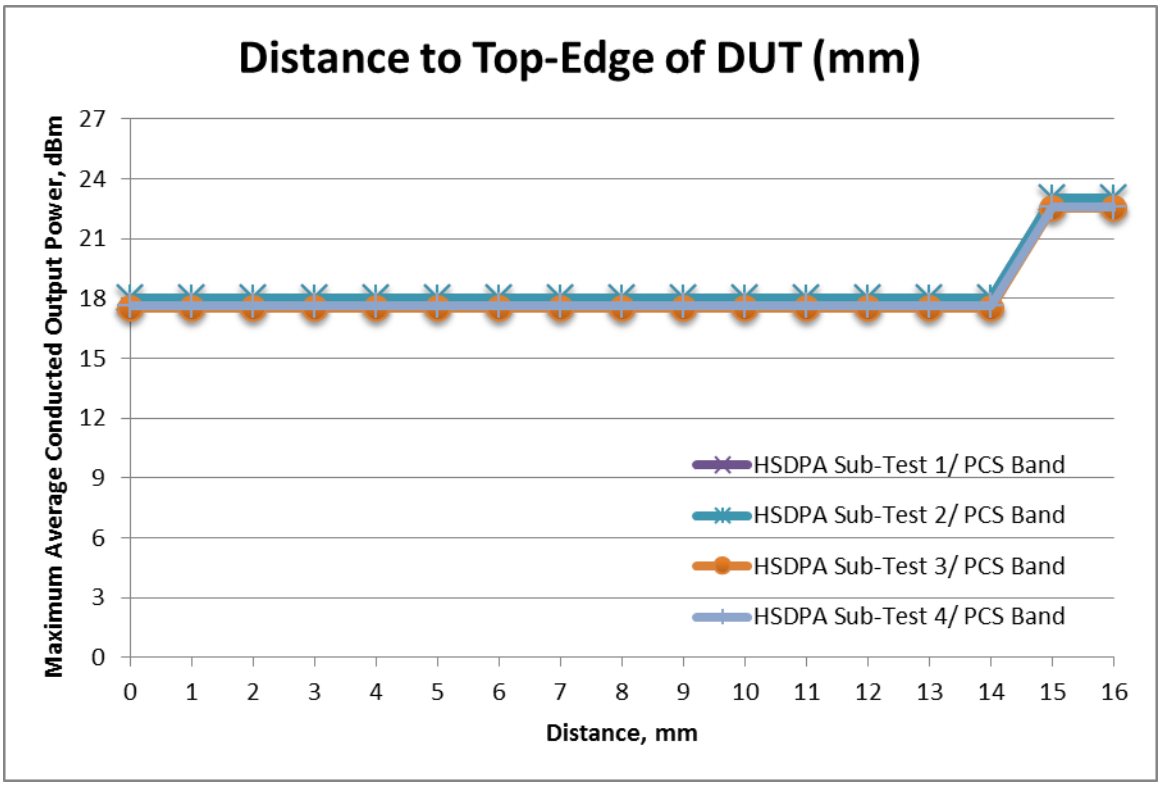


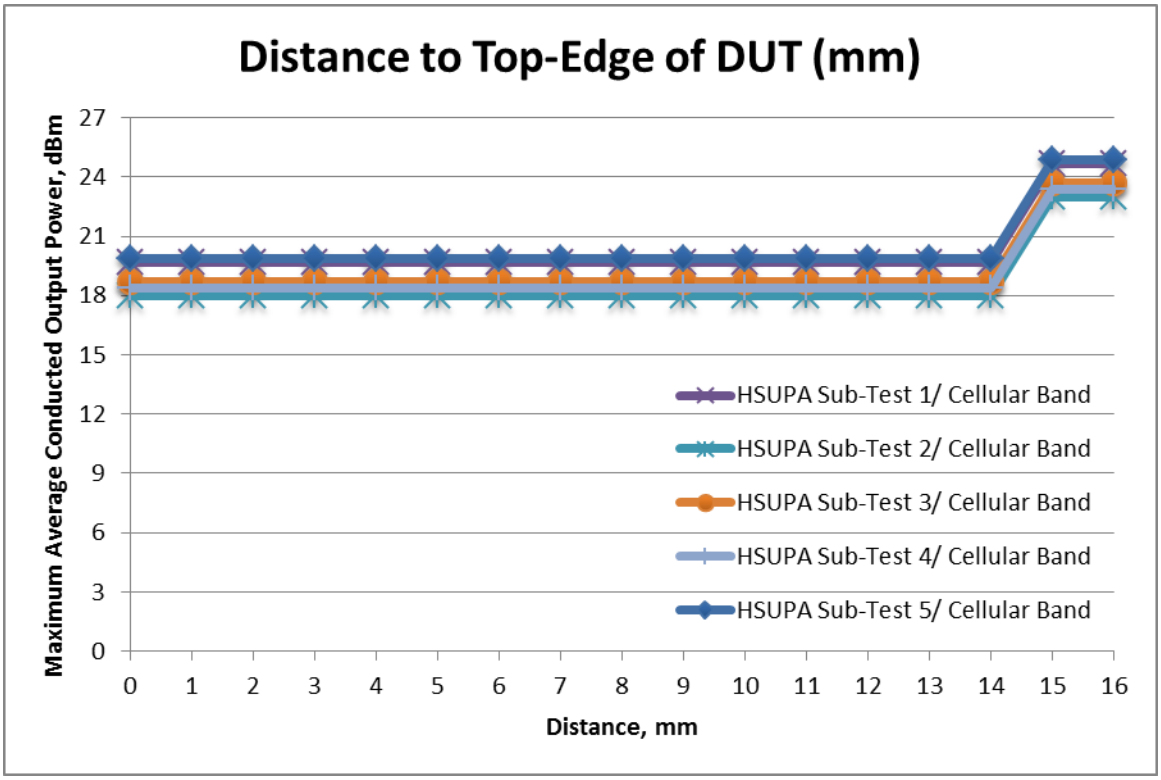



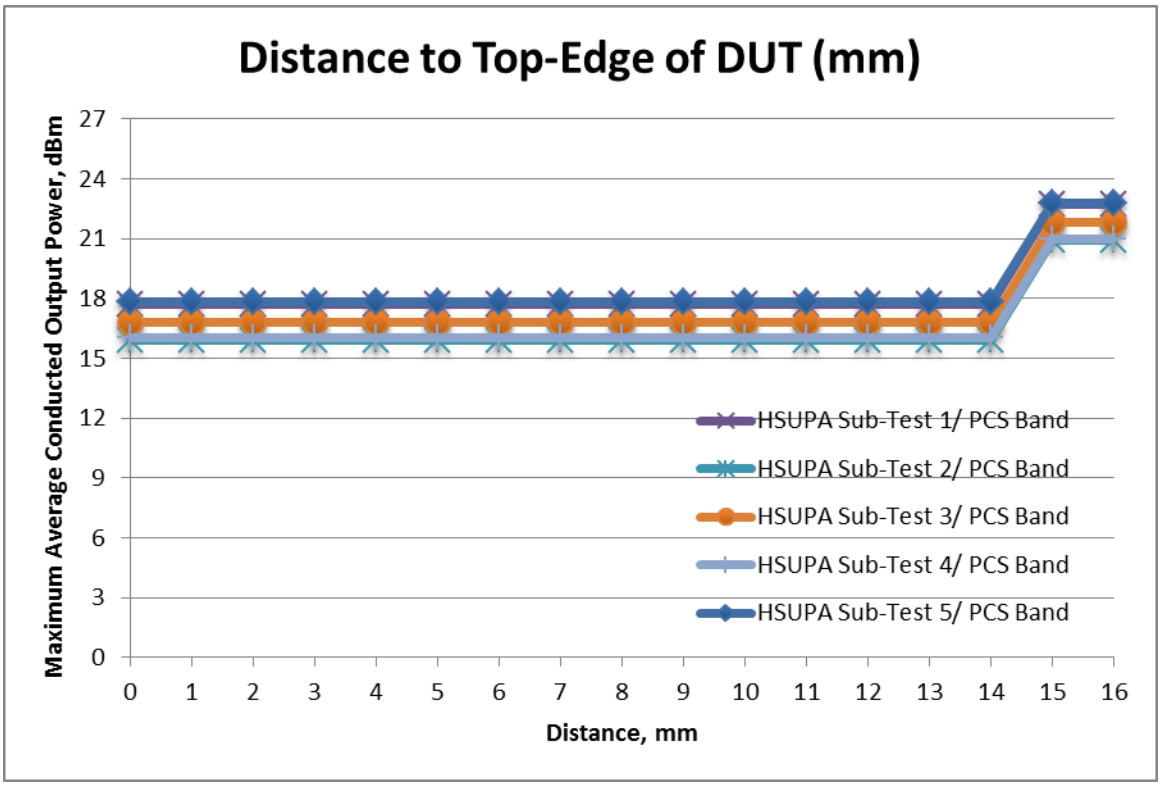


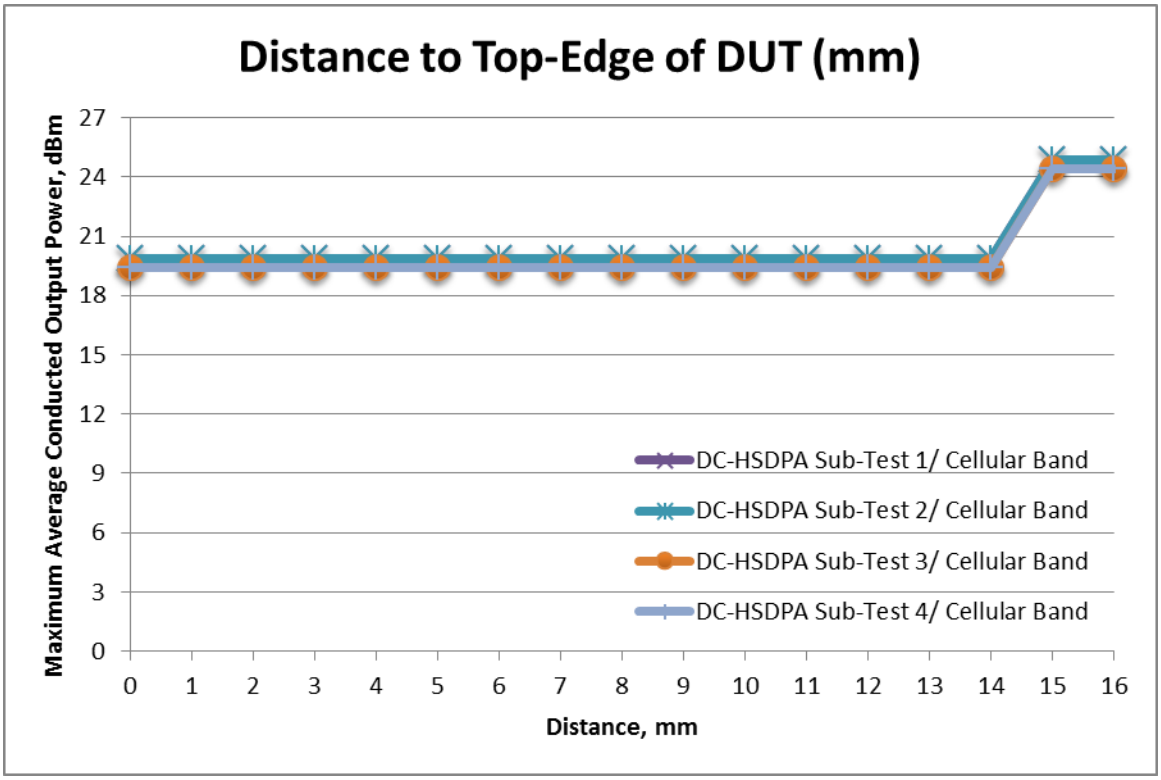



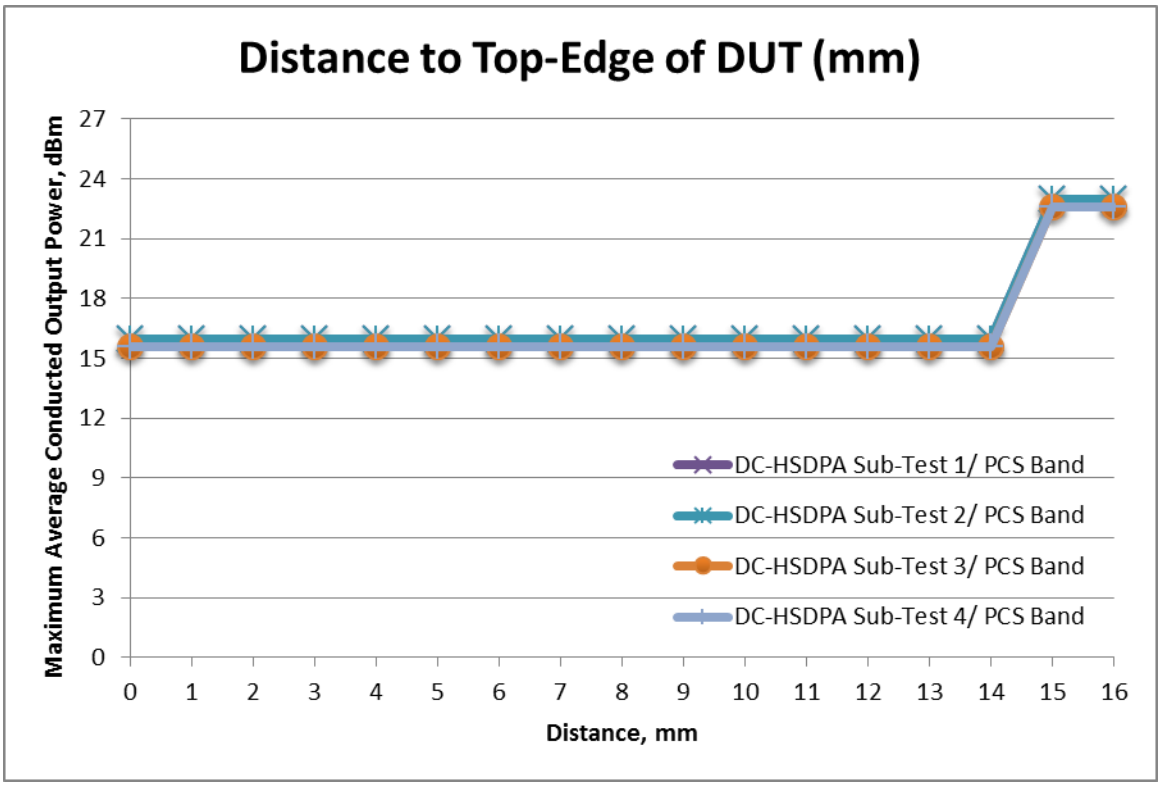


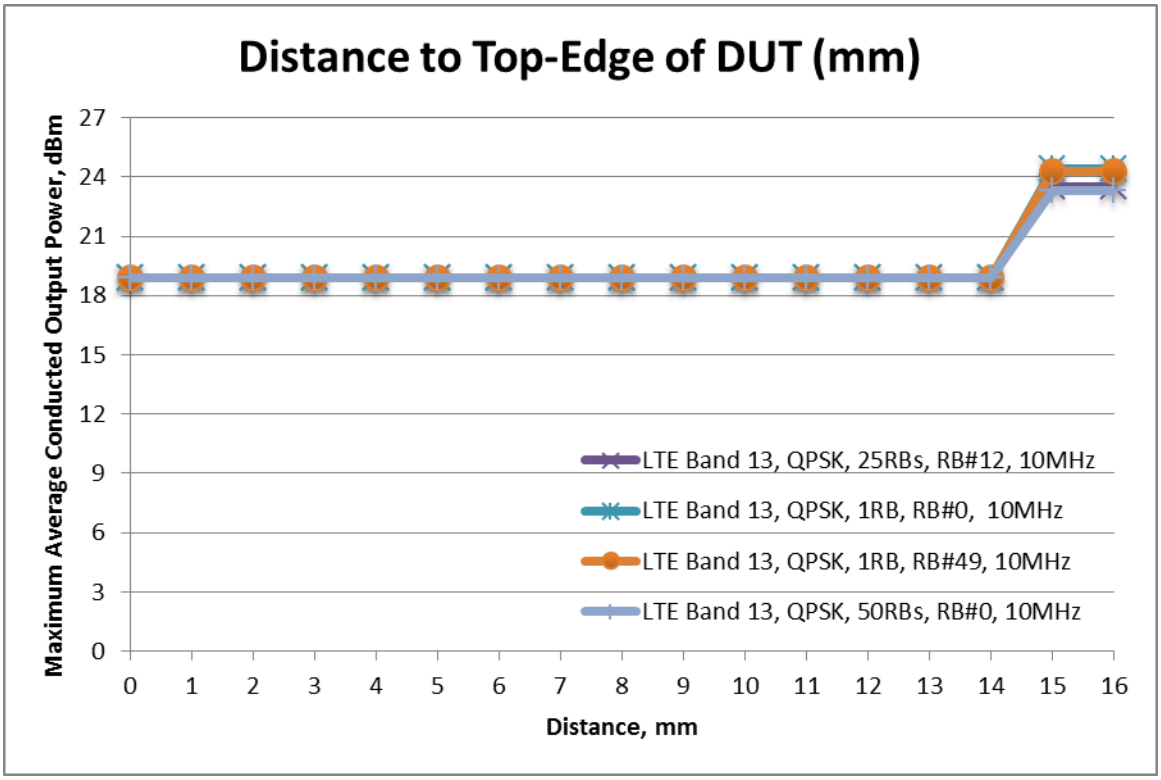



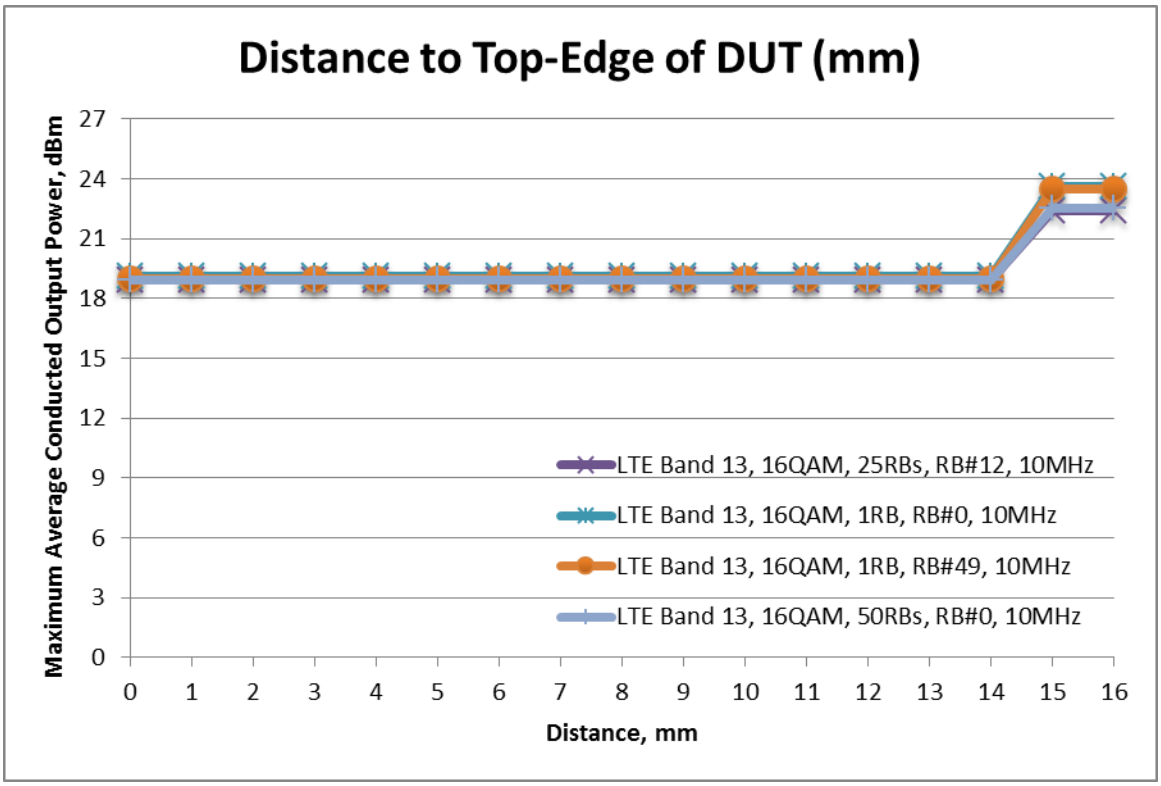






# 7. RF Output Power Measurement

## 7.1. GSM

GPRS (GMSK) - Coding Scheme: CS1

| GPRS | | | GMSK | | | | GMSK | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Band | Ch | Freq. (MHz) | w/o Pwr back-off | | w/ Pwr back-off | | w/o Pwr back-off | | w/ Pwr back-off | |
| | | | 1-Slot | Frame Avg | 1-Slot | Frame Avg | 2-Slot | Frame Avg | 2-Slot | Frame Avg |
| GSM850 | 128 | 824.2 | 33.5 | 24.5 | 28.6 | 19.6 | 32.4 | **26.4** | 25.6 | **19.6** |
| | 190 | 836.6 | 33.5 | 24.5 | 28.6 | 19.6 | 32.5 | **26.5** | 25.7 | **19.7** |
| | 251 | 848.8 | 33.5 | 24.5 | 28.6 | 19.6 | 32.4 | **26.4** | 25.6 | **19.6** |
| GSM1900 | 512 | 1850.2 | 31.0 | 22.0 | 25.3 | 16.3 | 28.0 | **22.0** | 22.2 | **16.2** |
| | 661 | 1880 | 31.0 | 22.0 | 25.3 | 16.3 | 28.1 | **22.1** | 22.3 | **16.3** |
| | 810 | 1909.8 | 31.0 | 22.0 | 25.3 | 16.3 | 28.2 | **22.2** | 22.3 | **16.3** |

**Note:** The modulation for CS1 to CS4 is GMSK, so the above table reflects the conducted power in the GMSK modulation

EGPRS (8PSK, Coding Scheme: MCS5)

| EGPRS | | | 8PSK | | | | 8PSK | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Band | Ch | Freq. (MHz) | w/o Pwr back-off | | w/ Pwr back-off | | w/o Pwr back-off | | w/ Pwr back-off | |
| | | | 1-Slot | Frame Avg | 1-Slot | Frame Avg | 2-Slot | Frame Avg | 2-Slot | Frame Avg |
| GSM850 | 128 | 824.2 | 29.0 | 20.0 | 27.0 | 18.0 | 29.0 | 23.0 | 25.3 | 19.3 |
| | 190 | 836.6 | 29.0 | 20.0 | 27.1 | 18.1 | 29.0 | 23.0 | 25.4 | 19.4 |
| | 251 | 848.8 | 29.0 | 20.0 | 27.0 | 18.0 | 29.0 | 23.0 | 25.4 | 19.4 |
| GSM1900 | 512 | 1850.2 | 28.0 | 19.0 | 25.3 | 16.3 | 28.0 | 22.0 | 22.1 | 16.1 |
| | 661 | 1880 | 28.1 | 19.1 | 25.3 | 16.3 | 28.0 | 22.0 | 22.2 | 16.2 |
| | 810 | 1909.8 | 28.1 | 19.1 | 25.3 | 16.3 | 28.0 | 22.0 | 22.2 | 16.2 |

**Note:** The modulation for MCS5 to MCS9 is 8PSK, so the above table reflects the conducted power in the 8PSK modulation. The conducted power results for GPRS (GMSK), also apply to EGPRS (GMSK, MCS1 to MCS4) modes.

**Note(s):**

Since the source-based time-averaged output power for EGPRS mode is lower than that in the GPRS mode, therefore Body SAR test reduction is applicable for this device

## 7.2. UMTS (WCDMA)

**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 EUT supports power Class 3, which has a nominal maximum output power of 24 dBm (+1.7/-3.7).

| | | |
|---|---|---|
| | Mode | Rel99 |
| | Subtest | - |
| WCDMA General Settings | Loopback Mode | Test Mode 1 |
| | Rel99 RMC | 12.2kbps RMC |
| | Power Control Algorithm | Algorithm2 |
| | βc/βd | 8/15 |

**Results**

| Band | Mode | UL Ch No. | Freq. (MHz) | Tx Conducted Pwr (dBm) | |
|---|---|---|---|---|---|
| | | | | W/o Pwr back-off | W/ Pwr back-off |
| UMTS (WCDMA) Band V | Rel 99 (RMC, 12.2 kbps) | 4357 | 826.4 | 24.9 | 20.0 |
| | | 4408 | 836.6 | 25.0 | 20.1 |
| | | 4458 | 846.6 | 24.8 | 19.9 |
| UMTS (WCDMA) Band II | Rel 99 (RMC, 12.2 kbps) | 9262 | 1852.4 | 22.8 | 15.5 |
| | | 9400 | 1880.0 | 23.0 | 15.6 |
| | | 9538 | 1907.6 | 22.8 | 15.7 |

**HSDPA**

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

| | Mode | HSDPA | HSDPA | HSDPA | HSDPA |
|---|---|---|---|---|---|
| | Subtest | 1 | 2 | 3 | 4 |
| WCDMA General Settings | Loopback Mode | Test Mode 1 | | | |
| | Rel99 RMC | 12.2kbps RMC | | | |
| | HSDPA FRC | H-Set1 | | | |
| | Power Control Algorithm | Algorithm 2 | | | |
| | βc | 2/15 | 12/15 | 15/15 | 15/15 |
| | βd | 15/15 | 15/15 | 8/15 | 4/15 |
| | Bd (SF) | 64 | | | |
| | βc/βd | 2/15 | 12/15 | 15/8 | 15/4 |
| | βhs | 4/15 | 24/15 | 30/15 | 30/15 |
| | CM (dB) | 0 | 1 | 1.5 | 1.5 |
| HSDPA Specific Settings | $D_{ACK}$ | 8 | | | |
| | $D_{NAK}$ | 8 | | | |
| | DCQI | 8 | | | |
| | Ack-Nack repetition factor | 3 | | | |
| | CQI Feedback (Table 5.2B.4) | 4ms | | | |
| | CQI Repetition Factor (Table 5.2B.4) | 2 | | | |
| | Ahs =βhs/βc | 30/15 | | | |

**Results**

| Band | Mode | UL Ch No. | Freq. (MHz) | MPR | Tx Conducted Pwr (dBm) | |
|---|---|---|---|---|---|---|
| | | | | | W/o Pwr back-off | W/ Pwr back-off |
| UMTS (WCDMA) Band V | Subtest 1 | 4357 | 826.4 | 0 | 25.1 | 20.1 |
| | | 4408 | 836.6 | 0 | 25.0 | 20.0 |
| | | 4458 | 846.6 | 0 | 25.0 | 20.0 |
| | Subtest 2 | 4357 | 826.4 | 1 | 24.9 | 19.9 |
| | | 4408 | 836.6 | 1 | 24.9 | 19.9 |
| | | 4458 | 846.6 | 1 | 24.9 | 19.9 |
| | Subtest 3 | 4357 | 826.4 | 1.5 | 24.4 | 19.4 |
| | | 4408 | 836.6 | 1.5 | 24.4 | 19.4 |
| | | 4458 | 846.6 | 1.5 | 24.5 | 19.5 |
| | Subtest 4 | 4357 | 826.4 | 1.5 | 24.6 | 19.6 |
| | | 4408 | 836.6 | 1.5 | 24.5 | 19.5 |
| | | 4458 | 846.6 | 1.5 | 24.5 | 19.5 |
| UMTS (WCDMA) Band II | Subtest 1 | 9262 | 1852.4 | 0 | 23.0 | 18.0 |
| | | 9400 | 1880.0 | 0 | 23.0 | 18.0 |
| | | 9538 | 1907.6 | 0 | 22.9 | 17.9 |
| | Subtest 2 | 9262 | 1852.4 | 1 | 22.9 | 17.9 |
| | | 9400 | 1880.0 | 1 | 23.0 | 18.0 |
| | | 9538 | 1907.6 | 1 | 22.9 | 17.9 |
| | Subtest 3 | 9262 | 1852.4 | 1.5 | 22.4 | 17.4 |
| | | 9400 | 1880.0 | 1.5 | 22.5 | 17.5 |
| | | 9538 | 1907.6 | 1.5 | 22.5 | 17.5 |
| | Subtest 4 | 9262 | 1852.4 | 1.5 | 22.6 | 17.6 |
| | | 9400 | 1880.0 | 1.5 | 22.5 | 17.5 |
| | | 9538 | 1907.6 | 1.5 | 22.5 | 17.5 |

**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<br>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<br>E-TFCI PO 4<br>E-TFCI 67<br>E-TFCI PO 18<br>E-TFCI 71<br>E-TFCI PO 23<br>E-TFCI 75<br>E-TFCI PO 26<br>E-TFCI 81<br>E-TFCI PO 27 | | E-TFCI 11<br>E-TFCI PO 4<br>E-TFCI 92<br>E-TFCI PO 18 | E-TFCI 11<br>E-TFCI PO 4<br>E-TFCI 67<br>E-TFCI PO 18<br>E-TFCI 71<br>E-TFCI PO 23<br>E-TFCI 75<br>E-TFCI PO 26<br>E-TFCI 81<br>E-TFCI PO 27 | |

**Results**

| Band | Mode | UL Ch No. | Freq. (MHz) | MPR | Tx Conducted Pwr (dBm) | |
|---|---|---|---|---|---|---|
| | | | | | W/o Pwr back-off | W/ Pwr back-off |
| UMTS (WCDMA) Band V | Subtest 1 | 4357 | 826.4 | 0 | 24.7 | 19.7 |
| | | 4408 | 836.6 | 0 | 24.5 | 19.5 |
| | | 4458 | 846.6 | 0 | 24.5 | 19.5 |
| | Subtest 2 | 4357 | 826.4 | 2 | 23.0 | 18.0 |
| | | 4408 | 836.6 | 2 | 23.0 | 18.0 |
| | | 4458 | 846.6 | 2 | 23.0 | 18.0 |
| | Subtest 3 | 4357 | 826.4 | 1 | 23.6 | 18.6 |
| | | 4408 | 836.6 | 1 | 23.7 | 18.7 |
| | | 4458 | 846.6 | 1 | 23.4 | 18.4 |
| | Subtest 4 | 4357 | 826.4 | 2 | 23.4 | 18.4 |
| | | 4408 | 836.6 | 2 | 23.2 | 18.2 |
| | | 4458 | 846.6 | 2 | 23.3 | 18.3 |
| | Subtest 5 | 4357 | 826.4 | 0 | 24.8 | 19.8 |
| | | 4408 | 836.6 | 0 | 24.9 | 19.9 |
| | | 4458 | 846.6 | 0 | 24.7 | 19.7 |
| UMTS (WCDMA) Band II | Subtest 1 | 9262 | 1852.4 | 0 | 22.7 | 17.7 |
| | | 9400 | 1880.0 | 0 | 22.7 | 17.7 |
| | | 9538 | 1907.6 | 0 | 22.7 | 17.7 |
| | Subtest 2 | 9262 | 1852.4 | 2 | 20.7 | 15.7 |
| | | 9400 | 1880.0 | 2 | 20.9 | 15.9 |
| | | 9538 | 1907.6 | 2 | 20.9 | 15.9 |
| | Subtest 3 | 9262 | 1852.4 | 1 | 21.8 | 16.8 |
| | | 9400 | 1880.0 | 1 | 21.7 | 16.7 |
| | | 9538 | 1907.6 | 1 | 21.7 | 16.7 |
| | Subtest 4 | 9262 | 1852.4 | 2 | 21.0 | 16.0 |
| | | 9400 | 1880.0 | 2 | 20.8 | 15.8 |
| | | 9538 | 1907.6 | 2 | 20.8 | 15.8 |
| | Subtest 5 | 9262 | 1852.4 | 0 | 22.8 | 17.8 |
| | | 9400 | 1880.0 | 0 | 22.8 | 17.8 |
| | | 9538 | 1907.6 | 0 | 22.8 | 17.8 |

**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.

**DC-HSDPA (Rel 8, CAT 24)**

The following tests were completed according to procedures in section 7.3.13 of 3GPP TS34.108 v9.5.0. A summary of these settings are illustrated below:

Downlink Physical Channels are set as per 3GPP TS34.121-1 v9.0.0 E.5.0

**Table E.5.0: Levels for HSDPA connection setup**

| Parameter During Connection setup | Unit | Value |
|---|---|---|
| P-CPICH_Ec/Ior | dB | -10 |
| P-CCPCH and SCH_Ec/Ior | dB | -12 |
| PICH _Ec/Ior | dB | -15 |
| HS-PDSCH | dB | off |
| HS-SCCH_1 | dB | off |
| DPCH_Ec/Ior | dB | -5 |
| OCNS_Ec/Ior | dB | -3.1 |

Call is set up as per 3GPP TS34.108 v9.5.0 sub clause 7.3.13

The configurations of the fixed reference channels for HSDPA RF tests are described in 3GPP TS 34.121, annex C for FDD and 3GPP TS 34.122.

**Table C.8.1.12: Fixed Reference Channel H-Set 12**

| Parameter | Unit | Value |
|---|---|---|
| Nominal Avg. Inf. Bit Rate | kbps | 60 |
| Inter-TTI Distance | TTI's | 1 |
| Number of HARQ Processes | Proces ses | 6 |
| Information Bit Payload ( $N_{INF}$ ) | Bits | 120 |
| Number Code Blocks | Blocks | 1 |
| Binary Channel Bits Per TTI | Bits | 960 |
| Total Available SML's in UE | SML's | 19200 |
| Number of SML's per HARQ Proc. | SML's | 3200 |
| Coding Rate | | 0.15 |
| Number of Physical Channel Codes | Codes | 1 |
| Modulation | | QPSK |
| Note 1: The RMC is intended to be used for DC-HSDPA mode and both cells shall transmit with identical parameters as listed in the table. | | |
| Note 2: Maximum number of transmission is limited to 1, i.e., retransmission is not allowed. The redundancy and constellation version 0 shall be used. | | |

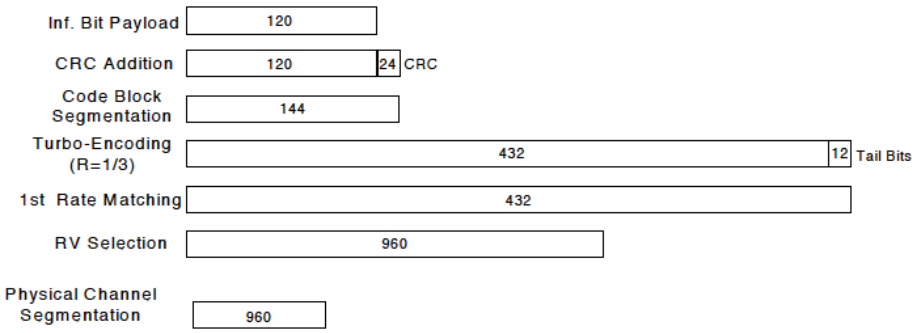



**Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)**

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

| | Mode | Rel6 HSDPA | Rel6 HSDPA | Rel6 HSDPA | Rel6 HSDPA |
|---|---|---|---|---|---|
| | Subtest | 1 | 2 | 3 | 4 |
| WCDMA General Settings | Loopback Mode | Test Mode 1 | | | |
| | Rel99 RMC | 12.2kbps RMC | | | |
| | HSDPA FRC | H-Set1 | | | |
| | Power Control Algorithm | Algorithm2 | | | |
| | βc | 2/15 | 12/15 | 15/15 | 15/15 |
| | βd | 15/15 | 15/15 | 8/15 | 4/15 |
| | βd (SF) | 64 | | | |
| | βc/βd | 2/15 | 12/15 | 15/8 | 15/4 |
| | βhs | 4/15 | 24/15 | 30/15 | 30/15 |
| | MPR | 0 | 0 | 0.5 | 0.5 |
| HSDPA Specific Settings | DACK | 8 | | | |
| | DNAK | 8 | | | |
| | DCQI | 8 | | | |
| | Ack-Nack Repetition factor | 3 | | | |
| | CQI Feedback | 4ms | | | |
| | CQI Repetition Factor | 2 | | | |
| | Ahs = βhs/ βc | 30/15 | | | |

Up commands are set continuously to set the UE to Max power.

**Results**

| Band | Mode | UL Ch No. | Freq. (MHz) | Tx Conducted Pwr (dBm) | |
|---|---|---|---|---|---|
| | | | | W/o Pwr back-off | W/ Pwr back-off |
| UMTS (WCDMA) Band V | Subtest 1 | 4357 | 826.4 | 24.9 | 19.9 |
| | | 4408 | 836.6 | 24.9 | 19.9 |
| | | 4458 | 846.6 | 24.9 | 19.9 |
| | Subtest 2 | 4357 | 826.4 | 24.9 | 19.9 |
| | | 4408 | 836.6 | 24.8 | 19.8 |
| | | 4458 | 846.6 | 24.8 | 19.8 |
| | Subtest 3 | 4357 | 826.4 | 24.4 | 19.4 |
| | | 4408 | 836.6 | 24.4 | 19.4 |
| | | 4458 | 846.6 | 24.4 | 19.4 |
| | Subtest 4 | 4357 | 826.4 | 24.4 | 19.4 |
| | | 4408 | 836.6 | 24.4 | 19.4 |
| | | 4458 | 846.6 | 24.3 | 19.3 |
| UMTS (WCDMA) Band II | Subtest 1 | 9262 | 1852.4 | 22.9 | 15.9 |
| | | 9400 | 1880.0 | 22.9 | 15.9 |
| | | 9538 | 1907.6 | 23.0 | 16.0 |
| | Subtest 2 | 9262 | 1852.4 | 22.9 | 15.9 |
| | | 9400 | 1880.0 | 22.9 | 15.9 |
| | | 9538 | 1907.6 | 22.9 | 15.9 |
| | Subtest 3 | 9262 | 1852.4 | 22.5 | 15.5 |
| | | 9400 | 1880.0 | 22.6 | 15.6 |
| | | 9538 | 1907.6 | 22.5 | 15.5 |
| | Subtest 4 | 9262 | 1852.4 | 22.5 | 15.5 |
| | | 9400 | 1880.0 | 22.6 | 15.6 |
| | | 9538 | 1907.6 | 22.6 | 15.6 |

**HSPA+**

Since 16QAM is not used for uplink, the uplink Category and release is same as HSUPA, i.e., CAT 6 Rel 6. Therefore, the RF conducted power is not measured.

## 7.3. CDMA

### 1xRTT

| CDMA | | | Avg Pwr | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | RC1 - SO55 (Loopback) | | RC3 - SO55 (Loopback) | | RC3 - SO32 (+F-SCH) | |
| Band | Ch | Freq. (MHz) | W/o Pwr back-off | W/ Pwr back-off | W/o Pwr back-off | W/ Pwr back-off | W/o Pwr back-off | W/ Pwr back-off |
| BC 0 | 1013 | 824.7 | 24.6 | 19.9 | 24.6 | 20.0 | 24.7 | 19.9 |
| | 384 | 836.52 | 24.5 | 20.0 | 24.7 | 20.1 | 24.7 | 20.0 |
| | 777 | 848.31 | 24.5 | 19.9 | 24.6 | 19.9 | 24.7 | 20.0 |
| BC 1 | 25 | 1851.25 | 22.9 | 15.5 | 23.0 | 15.5 | 22.9 | 15.5 |
| | 600 | 1880 | 23.0 | 15.5 | 23.0 | 15.5 | 23.0 | 15.5 |
| | 1175 | 1908.75 | 23.0 | 15.5 | 23.0 | 15.5 | 22.9 | 15.5 |

**Note(s):**

1. Per KDB941225 D01 SAR test for 3G devices v02, Body SAR evaluation for Primary antenna is performed in RC3/SO32 only. Body SAR for multiple code channel (FCH+SCH) is not required since the output power is not ¼ dB higher than RC3/SO32.

### 1xEv-Do Rel. 0

| Band | FTAP Rate | RTAP Rate | Channel | f (MHz) | Tx Conducted Power (dBm) | |
|---|---|---|---|---|---|---|
| | | | | | W/o Pwr back-off | W/ Pwr back-off |
| BC0 | 307.2 kbps (2 slot, QPSK) | 153.6 kbps | 1013 | 824.70 | 24.7 | 20.0 |
| | | | 384 | 836.52 | 24.7 | 19.9 |
| | | | 777 | 848.31 | 24.6 | 20.0 |
| BC1 | 307.2 kbps (2 slot, QPSK) | 153.6 kbps | 25 | 1851.25 | 22.9 | 15.5 |
| | | | 600 | 1880.00 | 23.0 | 15.5 |
| | | | 1175 | 1908.75 | 22.9 | 15.5 |

### 1xEv-Do Rev. A

| Band | FETAP Traffic Format | RETAP Data Payload Size | Channel | f (MHz) | Tx Conducted Power (dBm) | |
|---|---|---|---|---|---|---|
| | | | | | W/o Pwr back-off | W/ Pwr back-off |
| BC0 | 307.2k, QPSK/ ACK channel is transmitted at all the slots | 4096 | 1013 | 824.70 | 24.7 | 20.0 |
| | | | 384 | 836.52 | 24.7 | 19.9 |
| | | | 777 | 848.31 | 24.6 | 19.9 |
| BC1 | 307.2k, QPSK/ ACK channel is transmitted at all the slots | 4096 | 25 | 1851.25 | 22.9 | 15.5 |
| | | | 600 | 1880.00 | 22.9 | 15.5 |
| | | | 1175 | 1908.75 | 22.9 | 15.4 |

**Note(s):**

1. SAR for Subtype 2 Physical layer configurations in not required for Rev. A since the maximum average output of each RF channel is less than that measured in Subtype 0/1 Physical layer configurations as per KDB 941225 D01 SAR test for 3G devices v02.

## 7.4. 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 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<br>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 | *W/ Pwr back-off |
| 13 | 10 | 23230 | 782.0 | QPSK | 25 | 12 | 1 | 1 | 23.5 | 18.9 |
| | | | | | 1 | 0 | 0 | 0 | 24.3 | 18.9 |
| | | | | | 1 | 49 | 0 | 0 | 24.3 | 18.9 |
| | | | | | 50 | 0 | 1 | 1 | 23.3 | 18.9 |
| | | | | 16QAM | 25 | 12 | 2 | 2 | 22.4 | 18.9 |
| | | | | | 1 | 0 | 1 | 1 | 23.6 | 19.1 |
| | | | | | 1 | 49 | 1 | 1 | 23.5 | 19.0 |
| | | | | | 50 | 0 | 2 | 2 | 22.5 | 18.9 |
| 13 | 5 | 23205 | 779.5 | QPSK | 12 | 6 | 1 | 1 | 23.4 | 18.9 |
| | | | | | 1 | 0 | 0 | 0 | 24.4 | 18.9 |
| | | | | | 1 | 24 | 0 | 0 | 24.3 | 18.9 |
| | | | | | 25 | 0 | 1 | 1 | 23.4 | 18.9 |
| | | | | 16QAM | 12 | 6 | 2 | 2 | 22.4 | 18.9 |
| | | | | | 1 | 0 | 1 | 1 | 23.5 | 18.9 |
| | | | | | 1 | 24 | 1 | 1 | 23.5 | 18.9 |
| | | | | | 25 | 0 | 2 | 2 | 22.5 | 19.0 |
| | | 23230 | 782.0 | QPSK | 12 | 6 | 1 | 1 | 23.3 | 18.9 |
| | | | | | 1 | 0 | 0 | 0 | 24.4 | 18.9 |
| | | | | | 1 | 24 | 0 | 0 | 24.4 | 18.9 |
| | | | | | 25 | 0 | 1 | 1 | 23.5 | 18.9 |
| | | | | 16QAM | 12 | 6 | 2 | 2 | 22.4 | 18.9 |
| | | | | | 1 | 0 | 1 | 1 | 23.5 | 18.9 |
| | | | | | 1 | 24 | 1 | 1 | 23.5 | 18.9 |
| | | | | | 25 | 0 | 2 | 2 | 22.6 | 19.0 |
| | | 23255 | 784.5 | QPSK | 12 | 6 | 1 | 1 | 23.3 | 18.9 |
| | | | | | 1 | 0 | 0 | 0 | 24.4 | 18.9 |
| | | | | | 1 | 24 | 0 | 0 | 24.3 | 19.0 |
| | | | | | 25 | 0 | 1 | 1 | 23.5 | 18.9 |
| | | | | 16QAM | 12 | 6 | 2 | 2 | 22.4 | 18.9 |
| | | | | | 1 | 0 | 1 | 1 | 23.5 | 18.9 |
| | | | | | 1 | 24 | 1 | 1 | 23.4 | 19.0 |
| | | | | | 25 | 0 | 2 | 2 | 22.5 | 18.9 |

**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.

## 7.5. Wi-Fi

**2.4 GHz**

| Mode | Channel # | Freq. (MHz) | Conducted Avg Power | |
|---|---|---|---|---|
| | | | (dBm) | (mW) |
| 802.11b | 1 | 2412 | 16.5 | 44.67 |
| | 6 | 2437 | 16.6 | 45.71 |
| | 11 | 2462 | 16.5 | 44.67 |
| 802.11g | 1 | 2412 | 16.0 | 39.81 |
| | 6 | 2437 | 16.5 | 44.67 |
| | 11 | 2462 | 16.0 | 39.81 |
| 802.11n (HT20) | 1 | 2412 | 15.5 | 35.48 |
| | 6 | 2437 | 16.5 | 44.67 |
| | 11 | 2462 | 15.0 | 31.62 |

**5.2 GHz band (5150-5250 MHz)**

| Mode | Channel # | Freq. (MHz) | Conducted Avg Power | |
|---|---|---|---|---|
| | | | (dBm) | (mW) |
| 802.11a | 36 | 5180 | 13.5 | 22.39 |
| | 40 | 5200 | 13.5 | 22.39 |
| | 48 | 5240 | 13.5 | 22.39 |
| 802.11n (HT20) | 36 | 5180 | 13.6 | 22.75 |
| | 40 | 5200 | 13.6 | 22.96 |
| | 48 | 5240 | 13.6 | 22.86 |

**5.3 GHz band (5250-5350 MHz)**

| Mode | Channel # | Freq. (MHz) | Conducted Avg Power | |
|---|---|---|---|---|
| | | | (dBm) | (mW) |
| 802.11a | 52 | 5260 | 17.5 | 56.23 |
| | 60 | 5300 | 17.5 | 56.23 |
| | 64 | 5320 | 16.5 | 44.67 |
| 802.11n (HT20) | 52 | 5260 | 17.4 | 54.95 |
| | 60 | 5300 | 17.4 | 54.95 |
| | 64 | 5320 | 16.4 | 43.65 |

**5.5 GHz band (5500-5700 MHz)**

| Mode | Channel # | Freq. (MHz) | Conducted Avg Power | |
|---|---|---|---|---|
| | | | (dBm) | (mW) |
| 802.11a | 100 | 5500 | 16.5 | 44.67 |
| | 120 | 5600 | 16.5 | 44.67 |
| | 140 | 5700 | 16.5 | 44.67 |
| 802.11n (HT20) | 100 | 5500 | 16.5 | 44.67 |
| | 120 | 5600 | 16.5 | 44.67 |
| | 140 | 5700 | 16.5 | 44.67 |

**5.8 GHz band (5725-5850 MHz)**

| Mode | Channel # | Freq. (MHz) | Conducted Avg Power | |
|---|---|---|---|---|
| | | | (dBm) | (mW) |
| 802.11a | 149 | 5745 | 17.5 | 56.23 |
| | 157 | 5785 | 17.5 | 56.23 |
| | 165 | 5825 | 17.4 | 54.95 |
| 802.11n (HT20) | 149 | 5745 | 17.5 | 56.23 |
| | 157 | 5785 | 17.5 | 56.23 |
| | 165 | 5825 | 17.5 | 56.23 |

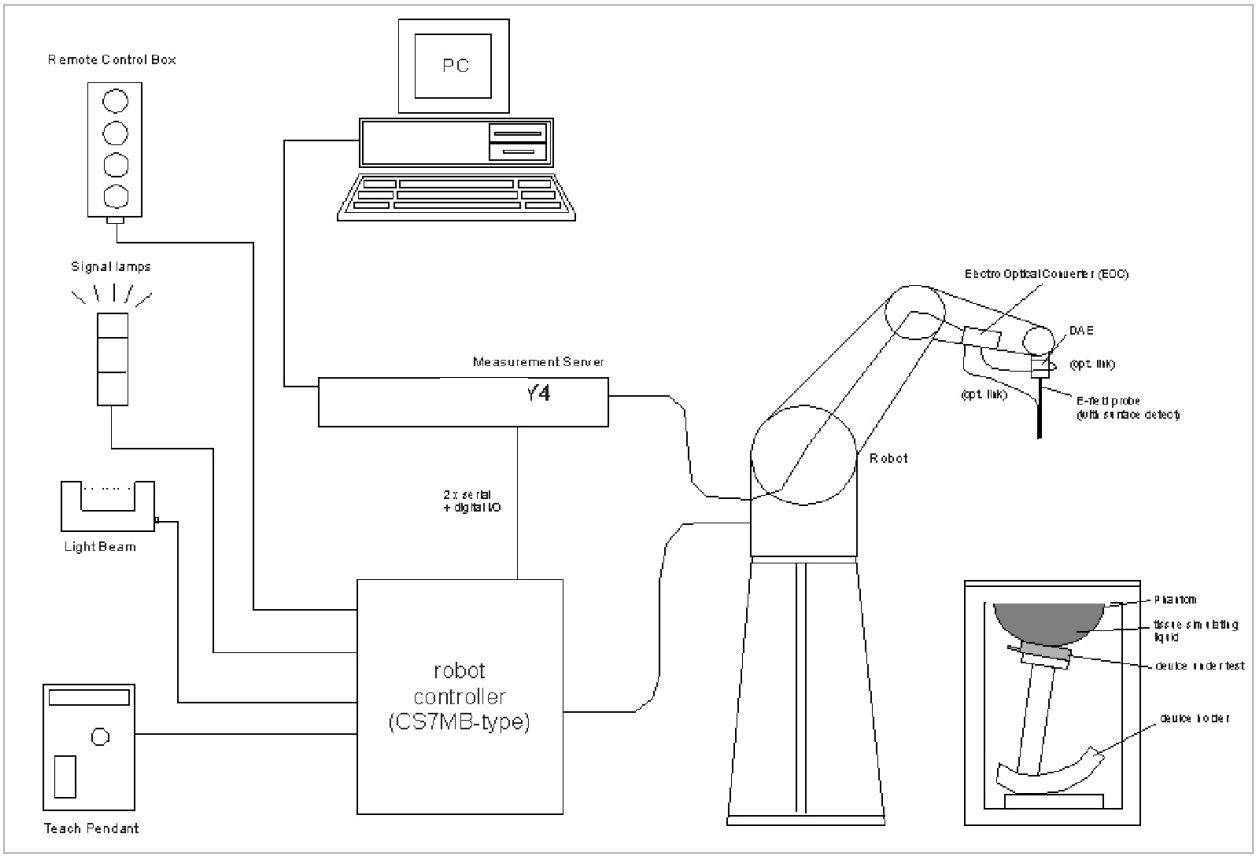
## 7.6. Bluetooth

| Mode | Channel # | Freq. (MHz) | Conducted Avg Power | |
|---|---|---|---|---|
| | | | (dBm) | (mW) |
| V2.1 + EDR, GFSK | 0 | 2402 | 11.9 | 15.49 |
| | 39 | 2441 | 11.7 | 14.79 |
| | 78 | 2480 | 10.8 | 12.02 |
| V2.1 + EDR, π/4 DQPSK | 0 | 2402 | 9.8 | 9.55 |
| | 39 | 2441 | 10.0 | 10.00 |
| | 78 | 2480 | 9.3 | 8.51 |
| V2.1 + EDR, 8-DPSK | 0 | 2402 | 9.9 | 9.77 |
| | 39 | 2441 | 10.0 | 10.00 |
| | 78 | 2480 | 9.3 | 8.51 |
| V4.0 LE, GFSK | 0 | 2402 | 8.8 | 7.59 |
| | 39 | 2441 | 8.9 | 7.76 |
| | 78 | 2480 | 8.7 | 7.41 |

**Note(s):**

Stand-alone SAR is not required as the output power is less than 25 mW [$60/f_{(GHz)}$].

# 8. System Specifications




**The DASY 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.

# 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

**Simulating Liquids for 5 GHz, Manufactured by SPEAG**

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

# 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 | |
|---|---|---|---|---|
| | $\varepsilon_r$ | $\sigma$ (S/m) | $\varepsilon_r$ | $\sigma$ (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 |

($\varepsilon_r$ = relative permittivity, $\sigma$ = conductivity and $\rho$ = 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 | |
|---|---|---|---|---|
| | $\varepsilon_r$ | $\sigma$ (S/m) | $\varepsilon_r$ | $\sigma$ (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 |

($\varepsilon_r$ = relative permittivity, $\sigma$ = conductivity and $\rho$ = 1000 kg/m$^3$)

## 10.1. Liquid Check Results

| Date | Freq. (MHz) | Liquid Parameters | | | Measured | Target | Delta (%) | Limit ±(%) |
|---|---|---|---|---|---|---|---|---|
| 10/10/2011 | Body 2450 | e' | 50.5230 | Relative Permittivity (εr): | 50.52 | 52.70 | -4.13 | 5 |
| | | e" | 14.5573 | Conductivity (σ): | 1.98 | 1.95 | 1.70 | 5 |
| | Body 2410 | e' | 50.6534 | Relative Permittivity (εr): | 50.52 | 52.70 | -4.13 | 5 |
| | | e" | 14.4109 | Conductivity (σ): | 1.98 | 1.95 | 1.70 | 5 |
| | Body 2435 | e' | 50.5759 | Relative Permittivity (εr): | 50.52 | 52.70 | -4.13 | 5 |
| | | e" | 14.5011 | Conductivity (σ): | 1.98 | 1.95 | 1.70 | 5 |
| | Body 2465 | e' | 50.4696 | Relative Permittivity (εr): | 50.52 | 52.70 | **-4.13** | 5 |
| | | e" | 14.6156 | Conductivity (σ): | 1.98 | 1.95 | 1.70 | 5 |
| 10/10/2011 | Body 5180 | e' | 49.1209 | Relative Permittivity ($\epsilon_r$): | 49.12 | 49.05 | 0.15 | 10 |
| | | e" | 18.4112 | Conductivity (σ): | 5.30 | 5.27 | 0.60 | 5 |
| | Body 5200 | e' | 49.1282 | Relative Permittivity ($\epsilon_r$): | 49.13 | 49.02 | 0.22 | 10 |
| | | e" | 18.4697 | Conductivity (σ): | 5.34 | 5.29 | 0.86 | 5 |
| | Body 5500 | e' | 48.5634 | Relative Permittivity ($\epsilon_r$): | 48.56 | 48.61 | -0.10 | 10 |
| | | e" | 18.7437 | Conductivity (σ): | 5.73 | 5.64 | 1.55 | 5 |
| | Body 5800 | e' | 48.0852 | Relative Permittivity ($\epsilon_r$): | 48.09 | 48.20 | -0.24 | 10 |
| | | e" | 19.0479 | Conductivity (σ): | 6.14 | 6.00 | 2.38 | 5 |
| | Body 5825 | e' | 48.0422 | Relative Permittivity ($\epsilon_r$): | 48.04 | 48.20 | -0.33 | 10 |
| | | e" | 19.0569 | Conductivity (σ): | 6.17 | 6.00 | 2.87 | 5 |
| 10/11/2011 | Body 5180 | e' | 47.3328 | Relative Permittivity ($\epsilon_r$): | 47.33 | 49.05 | -3.49 | 10 |
| | | e" | 18.4853 | Conductivity (σ): | 5.32 | 5.27 | 1.00 | 5 |
| | Body 5200 | e' | 47.1193 | Relative Permittivity ($\epsilon_r$): | 47.12 | 49.02 | -3.88 | 10 |
| | | e" | 18.4634 | Conductivity (σ): | 5.34 | 5.29 | 0.83 | 5 |
| | Body 5500 | e' | 46.7376 | Relative Permittivity ($\epsilon_r$): | 46.74 | 48.61 | -3.86 | 10 |
| | | e" | 18.8227 | Conductivity (σ): | 5.76 | 5.64 | 1.98 | 5 |
| | Body 5800 | e' | 46.1847 | Relative Permittivity ($\epsilon_r$): | 46.18 | 48.20 | -4.18 | 10 |
| | | e" | 19.1559 | Conductivity (σ): | 6.18 | 6.00 | 2.96 | 5 |
| | Body 5825 | e' | 46.0593 | Relative Permittivity ($\epsilon_r$): | 46.06 | 48.20 | -4.44 | 10 |
| | | e" | 19.1725 | Conductivity (σ): | 6.21 | 6.00 | 3.50 | 5 |
| 10/11/2011 | Body 2450 | e' | 54.0530 | Relative Permittivity ($\epsilon_r$): | 54.05 | 52.70 | 2.57 | 5 |
| | | e" | 13.6199 | Conductivity (σ): | 1.86 | 1.95 | -4.85 | 5 |
| | Body 2410 | e' | 54.1646 | Relative Permittivity ($\epsilon_r$): | 54.16 | 52.76 | 2.66 | 5 |
| | | e" | 13.5487 | Conductivity (σ): | 1.82 | 1.91 | -4.82 | 5 |
| | Body 2435 | e' | 54.0939 | Relative Permittivity ($\epsilon_r$): | 54.09 | 52.73 | 2.59 | 5 |
| | | e" | 13.5605 | Conductivity (σ): | 1.84 | 1.93 | **-4.92** | 5 |
| | Body 2465 | e' | 54.0080 | Relative Permittivity ($\epsilon_r$): | 54.01 | 52.68 | 2.52 | 5 |
| | | e" | 13.6836 | Conductivity (σ): | 1.88 | 1.97 | -4.85 | 5 |

Liquid Check Results (continued)

| Date | Freq. (MHz) | Liquid Parameters | | | Measured | Target | Delta (%) | Limit ±(%) |
|---|---|---|---|---|---|---|---|---|
| 10/11/2011 | Body 5200 | e' | 49.2153 | Relative Permittivity ($\epsilon_r$): | 49.22 | 49.02 | 0.40 | 10 |
| | | e" | 18.8478 | Conductivity (σ): | 5.45 | 5.29 | 2.93 | 5 |
| | Body 5180 | e' | 49.2245 | Relative Permittivity ($\epsilon_r$): | 49.22 | 49.05 | 0.36 | 10 |
| | | e" | 18.8052 | Conductivity (σ): | 5.42 | 5.27 | 2.75 | 5 |
| | Body 5250 | e' | 49.1116 | Relative Permittivity ($\epsilon_r$): | 49.11 | 48.95 | 0.33 | 10 |
| | | e" | 18.8602 | Conductivity (σ): | 5.51 | 5.35 | 2.85 | 5 |
| | Body 5320 | e' | 49.0038 | Relative Permittivity ($\epsilon_r$): | 49.00 | 48.86 | 0.30 | 10 |
| | | e" | 18.9581 | Conductivity (σ): | 5.61 | 5.43 | 3.19 | 5 |
| 10/12/2011 | Body 5180 | e' | 48.3255 | Relative Permittivity ($\epsilon_r$): | 48.33 | 49.05 | -1.47 | 10 |
| | | e" | 18.3454 | Conductivity (σ): | 5.28 | 5.27 | 0.24 | 5 |
| | Body 5200 | e' | 48.3026 | Relative Permittivity ($\epsilon_r$): | 48.30 | 49.02 | -1.46 | 10 |
| | | e" | 18.3780 | Conductivity (σ): | 5.31 | 5.29 | 0.36 | 5 |
| | Body 5500 | e' | 47.7738 | Relative Permittivity ($\epsilon_r$): | 47.77 | 48.61 | -1.73 | 10 |
| | | e" | 18.6793 | Conductivity (σ): | 5.71 | 5.64 | 1.20 | 5 |
| | Body 5800 | e' | 47.2691 | Relative Permittivity ($\epsilon_r$): | 47.27 | 48.20 | -1.93 | 10 |
| | | e" | 18.9790 | Conductivity (σ): | 6.12 | 6.00 | 2.01 | 5 |
| | Body 5825 | e' | 47.2315 | Relative Permittivity ($\epsilon_r$): | 47.23 | 48.20 | -2.01 | 10 |
| | | e" | 19.0031 | Conductivity (σ): | 6.15 | 6.00 | 2.58 | 5 |
| 10/12/2011 | Body 5180 | e' | 48.7356 | Relative Permittivity ($\epsilon_r$): | 48.74 | 49.05 | -0.63 | 10 |
| | | e" | 18.2183 | Conductivity (σ): | 5.25 | 5.27 | -0.46 | 5 |
| | Body 5200 | e' | 48.7131 | Relative Permittivity ($\epsilon_r$): | 48.71 | 49.02 | -0.63 | 10 |
| | | e" | 18.2494 | Conductivity (σ): | 5.28 | 5.29 | -0.34 | 5 |
| | Body 5500 | e' | 48.1450 | Relative Permittivity ($\epsilon_r$): | 48.15 | 48.61 | -0.96 | 10 |
| | | e" | 18.4791 | Conductivity (σ): | 5.65 | 5.64 | 0.12 | 5 |
| | Body 5800 | e' | 47.6225 | Relative Permittivity ($\epsilon_r$): | 47.62 | 48.20 | -1.20 | 10 |
| | | e" | 18.7524 | Conductivity (σ): | 6.05 | 6.00 | 0.79 | 5 |
| | Body 5825 | e' | 47.5898 | Relative Permittivity ($\epsilon_r$): | 47.59 | 48.20 | -1.27 | 10 |
| | | e" | 18.7720 | Conductivity (σ): | 6.08 | 6.00 | 1.33 | 5 |
| 10/24/2011 | Body 5180 | e' | 48.5943 | Relative Permittivity ($\epsilon_r$): | 48.59 | 49.05 | -0.92 | 10 |
| | | e" | 18.8801 | Conductivity (σ): | 5.44 | 5.27 | 3.16 | 5 |
| | Body 5200 | e' | 48.5741 | Relative Permittivity ($\epsilon_r$): | 48.57 | 49.02 | -0.91 | 10 |
| | | e" | 18.9207 | Conductivity (σ): | 5.47 | 5.29 | 3.32 | 5 |
| | Body 5500 | e' | 47.9902 | Relative Permittivity ($\epsilon_r$): | 47.99 | 48.61 | -1.28 | 10 |
| | | e" | 19.2292 | Conductivity (σ): | 5.88 | 5.64 | 4.18 | 5 |
| | Body 5700 | e' | 47.6270 | Relative Permittivity ($\epsilon_r$): | 47.63 | 48.34 | -1.48 | 10 |
| | | e" | 19.4345 | Conductivity (σ): | 6.16 | 5.88 | 4.80 | 5 |

Liquid Check Results (continued)

| Date | Freq. (MHz) | Liquid Parameters | | | Measured | Target | Delta (%) | Limit ±(%) |
|---|---|---|---|---|---|---|---|---|
| 10/24/2011 | Body 1900 | e' | 51.6580 | Relative Permittivity ($\epsilon_r$): | 51.66 | 53.30 | -3.08 | 5 |
| | | e" | 13.9541 | Conductivity (σ): | 1.47 | 1.52 | -3.01 | 5 |
| | Body 1850 | e' | 51.8242 | Relative Permittivity ($\epsilon_r$): | 51.82 | 53.30 | -2.77 | 5 |
| | | e" | 14.0500 | Conductivity (σ): | 1.45 | 1.52 | -4.92 | 5 |
| | Body 1880 | e' | 51.7230 | Relative Permittivity ($\epsilon_r$): | 51.72 | 53.30 | -2.96 | 5 |
| | | e" | 13.8918 | Conductivity (σ): | 1.45 | 1.52 | -4.46 | 5 |
| | Body 1910 | e' | 51.6274 | Relative Permittivity ($\epsilon_r$): | 51.63 | 53.30 | -3.14 | 5 |
| | | e" | 13.9842 | Conductivity (σ): | 1.49 | 1.52 | -2.29 | 5 |
| 10/25/2011 | Body 2450 | e' | 51.1919 | Relative Permittivity ($\epsilon_r$): | 51.19 | 52.70 | -2.86 | 5 |
| | | e" | 14.2594 | Conductivity (σ): | 1.94 | 1.95 | -0.38 | 5 |
| | Body 2410 | e' | 51.3125 | Relative Permittivity (εr): | 50.52 | 52.70 | -4.13 | 5 |
| | | e" | 14.0991 | Conductivity (σ): | 1.98 | 1.95 | 1.70 | 5 |
| | Body 2435 | e' | 51.2404 | Relative Permittivity (εr): | 50.52 | 52.70 | -4.13 | 5 |
| | | e" | 14.1995 | Conductivity (σ): | 1.98 | 1.95 | 1.70 | 5 |
| | Body 2465 | e' | 51.1372 | Relative Permittivity (εr): | 50.52 | 52.70 | -4.13 | 5 |
| | | e" | 14.3225 | Conductivity (σ): | 1.98 | 1.95 | 1.70 | 5 |
| 10/25/2011 | Body 835 | e' | 53.8428 | Relative Permittivity (εr): | 55.84 | 55.20 | 1.16 | 5 |
| | | e" | 20.6159 | Conductivity (σ): | 0.97 | 0.97 | -0.45 | 5 |
| | Body 820 | e' | 54.0048 | Relative Permittivity (εr): | 55.84 | 55.26 | 1.05 | 5 |
| | | e" | 20.6476 | Conductivity (σ): | 0.96 | 0.97 | -1.35 | 5 |
| | Body 850 | e' | 53.6853 | Relative Permittivity (εr): | 55.84 | 55.17 | 1.21 | 5 |
| | | e" | 20.5874 | Conductivity (σ): | 0.98 | 0.98 | -0.24 | 5 |
| 10/25/2011 | Body 1900 | e' | 51.6338 | Relative Permittivity ($\epsilon_r$): | 51.63 | 53.30 | -3.13 | 5 |
| | | e" | 14.2678 | Conductivity (σ): | 1.51 | 1.52 | -0.83 | 5 |
| | Body 1850 | e' | 51.8044 | Relative Permittivity ($\epsilon_r$): | 51.80 | 53.30 | -2.81 | 5 |
| | | e" | 14.1085 | Conductivity (σ): | 1.45 | 1.52 | -4.52 | 5 |
| | Body 1880 | e' | 51.6995 | Relative Permittivity ($\epsilon_r$): | 51.70 | 53.30 | -3.00 | 5 |
| | | e" | 14.2027 | Conductivity (σ): | 1.48 | 1.52 | -2.32 | 5 |
| | Body 1910 | e' | 51.6050 | Relative Permittivity ($\epsilon_r$): | 51.61 | 53.30 | -3.18 | 5 |
| | | e" | 14.3027 | Conductivity (σ): | 1.52 | 1.52 | -0.07 | 5 |
| 10/26/2011 | Body 835 | e' | 54.5939 | Relative Permittivity (εr): | 55.84 | 55.20 | 1.16 | 5 |
| | | e" | 20.6764 | Conductivity (σ): | 0.97 | 0.97 | -0.45 | 5 |
| | Body 820 | e' | 54.7595 | Relative Permittivity (εr): | 55.84 | 55.26 | 1.05 | 5 |
| | | e" | 20.7083 | Conductivity (σ): | 0.96 | 0.97 | -1.35 | 5 |
| | Body 850 | e' | 54.4321 | Relative Permittivity (εr): | 55.84 | 55.17 | 1.21 | 5 |
| | | e" | 20.6441 | Conductivity (σ): | 0.98 | 0.98 | -0.24 | 5 |

Liquid Check Results (continued)

| Date | Freq. (MHz) | Liquid Parameters | | | Measured | Target | Delta (%) | Limit ±(%) |
|---|---|---|---|---|---|---|---|---|
| 10/26/2011 | Body 1900 | e' | 52.4246 | Relative Permittivity ($\epsilon_r$): | 52.42 | 53.30 | -1.64 | 5 |
| | | e" | 14.6648 | Conductivity (σ): | 1.55 | 1.52 | 1.93 | 5 |
| | Body 1850 | e' | 52.5964 | Relative Permittivity ($\epsilon_r$): | 52.60 | 53.30 | -1.32 | 5 |
| | | e" | 14.5383 | Conductivity (σ): | 1.50 | 1.52 | -1.61 | 5 |
| | Body 1880 | e' | 52.4859 | Relative Permittivity ($\epsilon_r$): | 52.49 | 53.30 | -1.53 | 5 |
| | | e" | 14.6170 | Conductivity (σ): | 1.53 | 1.52 | 0.52 | 5 |
| | Body 1910 | e' | 52.3987 | Relative Permittivity ($\epsilon_r$): | 52.40 | 53.30 | -1.69 | 5 |
| | | e" | 14.6886 | Conductivity (σ): | 1.56 | 1.52 | 2.63 | 5 |
| 10/27/2011 | Body 835 | e' | 55.8403 | Relative Permittivity (εr): | 55.84 | 55.20 | 1.16 | 5 |
| | | e" | 20.7990 | Conductivity (σ): | 0.97 | 0.97 | -0.45 | 5 |
| | Body 820 | e' | 55.9929 | Relative Permittivity (εr): | 55.84 | 55.20 | 1.16 | 5 |
| | | e" | 20.8459 | Conductivity (σ): | 0.97 | 0.97 | -0.26 | 5 |
| | Body 850 | e' | 55.6987 | Relative Permittivity (εr): | 55.84 | 55.17 | 1.21 | 5 |
| | | e" | 20.7605 | Conductivity (σ): | 0.98 | 0.98 | -0.24 | 5 |
| 10/27/2011 | Body 1900 | e' | 53.7384 | Relative Permittivity ($\epsilon_r$): | 53.74 | 53.30 | 0.82 | 5 |
| | | e" | 14.7472 | Conductivity (σ): | 1.56 | 1.52 | 2.50 | 5 |
| | Body 1850 | e' | 53.9371 | Relative Permittivity ($\epsilon_r$): | 53.94 | 53.30 | 1.20 | 5 |
| | | e" | 14.5449 | Conductivity (σ): | 1.50 | 1.52 | -1.57 | 5 |
| | Body 1880 | e' | 53.8109 | Relative Permittivity ($\epsilon_r$): | 53.81 | 53.30 | 0.96 | 5 |
| | | e" | 14.6712 | Conductivity (σ): | 1.53 | 1.52 | 0.90 | 5 |
| | Body 1910 | e' | 53.7045 | Relative Permittivity ($\epsilon_r$): | 53.70 | 53.30 | 0.76 | 5 |
| | | e" | 14.7839 | Conductivity (σ): | 1.57 | 1.52 | 3.29 | 5 |
| 10/28/2011 | Body 835 | e' | 55.4998 | Relative Permittivity (εr): | 55.5 | 55.2 | 0.54 | 5 |
| | | e" | 20.7567 | Conductivity (σ): | 0.96 | 0.97 | -0.65 | 5 |
| | Body 820 | e' | 55.6366 | Relative Permittivity (εr): | 55.5 | 55.2 | 0.54 | 5 |
| | | e" | 20.8050 | Conductivity (σ): | 0.97 | 0.97 | -0.46 | 5 |
| | Body 850 | e' | 55.3640 | Relative Permittivity (εr): | 55.5 | 55.17 | 0.6 | 5 |
| | | e" | 20.7221 | Conductivity (σ): | 0.98 | 0.98 | -0.44 | 5 |
| 10/28/2011 | Body 1900 | e' | 51.2267 | Relative Permittivity ($\epsilon_r$): | 51.23 | 53.30 | -3.89 | 5 |
| | | e" | 14.3405 | Conductivity (σ): | 1.52 | 1.52 | -0.33 | 5 |
| | Body 1850 | e' | 51.3825 | Relative Permittivity ($\epsilon_r$): | 51.38 | 53.30 | -3.60 | 5 |
| | | e" | 14.1765 | Conductivity (σ): | 1.46 | 1.52 | -4.06 | 5 |
| | Body 1880 | e' | 51.2868 | Relative Permittivity ($\epsilon_r$): | 51.29 | 53.30 | -3.78 | 5 |
| | | e" | 14.2741 | Conductivity (σ): | 1.49 | 1.52 | -1.83 | 5 |
| | Body 1910 | e' | 51.1981 | Relative Permittivity ($\epsilon_r$): | 51.20 | 53.30 | -3.94 | 5 |
| | | e" | 14.3717 | Conductivity (σ): | 1.53 | 1.52 | 0.41 | 5 |

Liquid Check Results (continued)

| Date | Freq. (MHz) | Liquid Parameters | | | Measured | Target | Delta (%) | Limit ±(%) |
|---|---|---|---|---|---|---|---|---|
| 10/31/2011 | Body 835 | e' | 54.0904 | Relative Permittivity (εr): | 54.09 | 55.20 | -2.01 | 5 |
| | | e" | 20.8454 | Conductivity (σ): | 0.97 | 0.97 | -0.22 | 5 |
| | Body 820 | e' | 54.2477 | Relative Permittivity (εr): | 54.09 | 55.20 | -2.01 | 5 |
| | | e" | 20.8777 | Conductivity (σ): | 0.97 | 0.97 | -0.03 | 5 |
| | Body 850 | e' | 53.9344 | Relative Permittivity (εr): | 54.09 | 55.17 | -1.96 | 5 |
| | | e" | 20.8091 | Conductivity (σ): | 0.98 | 0.98 | -0.02 | 5 |
| 10/31/2011 | Body 1900 | e' | 54.9461 | Relative Permittivity ($\varepsilon_r$): | 54.95 | 53.30 | 3.09 | 5 |
| | | e" | 14.8546 | Conductivity (σ): | 1.57 | 1.52 | 3.25 | 5 |
| | Body 1850 | e' | 55.1052 | Relative Permittivity ($\varepsilon_r$): | 55.11 | 53.30 | 3.39 | 5 |
| | | e" | 14.6611 | Conductivity (σ): | 1.51 | 1.52 | -0.78 | 5 |
| | Body 1880 | e' | 55.0089 | Relative Permittivity ($\varepsilon_r$): | 55.01 | 53.30 | 3.21 | 5 |
| | | e" | 14.7816 | Conductivity (σ): | 1.55 | 1.52 | 1.66 | 5 |
| | Body 1910 | e' | 54.9137 | Relative Permittivity ($\varepsilon_r$): | 54.91 | 53.30 | 3.03 | 5 |
| | | e" | 14.8880 | Conductivity (σ): | 1.58 | 1.52 | 4.02 | 5 |
| 11/1/2011 | Body 750 | e' | 55.7545 | Relative Permittivity (εr): | 55.75 | 55.55 | 0.38 | 5 |
| | | e" | 22.8228 | Conductivity (σ): | 0.95 | 0.96 | -1.17 | 5 |
| | Body 775 | e' | 55.5243 | Relative Permittivity (εr): | 55.75 | 55.45 | 0.55 | 5 |
| | | e" | 22.6143 | Conductivity (σ): | 0.99 | 0.97 | 2.51 | 5 |
| | Body 780 | e' | 55.4732 | Relative Permittivity (εr): | 55.75 | 55.43 | 0.58 | 5 |
| | | e" | 22.5827 | Conductivity (σ): | 0.99 | 0.97 | 2.80 | 5 |
| | Body 785 | e' | 55.4197 | Relative Permittivity (εr): | 55.75 | 55.43 | 0.58 | 5 |
| | | e" | 22.5522 | Conductivity (σ): | 1.00 | 0.97 | 3.12 | 5 |
| 11/1/2011 | Body 1900 | e' | 51.3581 | Relative Permittivity ($\varepsilon_r$): | 51.36 | 53.30 | -3.64 | 5 |
| | | e" | 14.5146 | Conductivity (σ): | 1.53 | 1.52 | 0.88 | 5 |
| | Body 1850 | e' | 51.5464 | Relative Permittivity ($\varepsilon_r$): | 51.55 | 53.30 | -3.29 | 5 |
| | | e" | 14.3591 | Conductivity (σ): | 1.48 | 1.52 | -2.83 | 5 |
| | Body 1880 | e' | 51.4281 | Relative Permittivity ($\varepsilon_r$): | 51.43 | 53.30 | -3.51 | 5 |
| | | e" | 14.4540 | Conductivity (σ): | 1.51 | 1.52 | -0.60 | 5 |
| | Body 1910 | e' | 51.3295 | Relative Permittivity ($\varepsilon_r$): | 51.33 | 53.30 | -3.70 | 5 |
| | | e" | 14.5439 | Conductivity (σ): | 1.54 | 1.52 | 1.62 | 5 |
| 11/2/2011 | Body 750 | e' | 53.1779 | Relative Permittivity (εr): | 53.18 | 55.55 | -4.27 | 5 |
| | | e" | 22.1534 | Conductivity (σ): | 0.92 | 0.96 | -4.17 | 5 |
| | Body 775 | e' | 52.8991 | Relative Permittivity (εr): | 53.18 | 55.45 | -4.09 | 5 |
| | | e" | 21.9708 | Conductivity (σ): | 0.96 | 0.97 | -1.03 | 5 |
| | Body 780 | e' | 52.8433 | Relative Permittivity (εr): | 53.18 | 55.43 | -4.06 | 5 |
| | | e" | 21.9381 | Conductivity (σ): | 0.96 | 0.97 | -1.03 | 5 |
| | Body 785 | e' | 52.7968 | Relative Permittivity (εr): | 53.18 | 55.43 | -4.06 | 5 |
| | | e" | 21.9078 | Conductivity (σ): | 0.97 | 0.97 | 0.00 | 5 |

Liquid Check Results (continued)

| Date | Freq. (MHz) | Liquid Parameters | | | Measured | Target | Delta (%) | Limit ±(%) |
|---|---|---|---|---|---|---|---|---|
| 11/2/2011 | Body 1900 | e' | 53.1960 | Relative Permittivity ($\epsilon_r$): | 53.20 | 53.30 | -0.20 | 5 |
| | | e" | 14.4606 | Conductivity (σ): | 1.53 | 1.52 | 0.51 | 5 |
| | Body 1850 | e' | 53.3955 | Relative Permittivity ($\epsilon_r$): | 53.40 | 53.30 | 0.18 | 5 |
| | | e" | 14.2637 | Conductivity (σ): | 1.47 | 1.52 | -3.47 | 5 |
| | Body 1880 | e' | 53.2794 | Relative Permittivity ($\epsilon_r$): | 53.28 | 53.30 | -0.04 | 5 |
| | | e" | 14.3816 | Conductivity (σ): | 1.50 | 1.52 | -1.09 | 5 |
| | Body 1910 | e' | 53.1603 | Relative Permittivity ($\epsilon_r$): | 53.16 | 53.30 | -0.26 | 5 |
| | | e" | 14.4982 | Conductivity (σ): | 1.54 | 1.52 | 1.30 | 5 |
| 11/3/2011 | Body 750 | e' | 53.5709 | Relative Permittivity ($\epsilon_r$): | 53.57 | 55.55 | -3.56 | 5 |
| | | e" | 22.0907 | Conductivity (σ): | 0.92 | 0.96 | -4.34 | 5 |
| | Body 775 | e' | 53.2973 | Relative Permittivity ($\epsilon_r$): | 53.30 | 55.45 | -3.88 | 5 |
| | | e" | 21.9176 | Conductivity (σ): | 0.94 | 0.97 | -2.13 | 5 |
| | Body 780 | e' | 53.2464 | Relative Permittivity ($\epsilon_r$): | 53.25 | 55.43 | -3.94 | 5 |
| | | e" | 21.8894 | Conductivity (σ): | 0.95 | 0.97 | -1.66 | 5 |
| | Body 785 | e' | 53.1998 | Relative Permittivity ($\epsilon_r$): | 53.20 | 55.41 | -3.99 | 5 |
| | | e" | 21.8592 | Conductivity (σ): | 0.95 | 0.97 | -1.21 | 5 |
| 11/3/2011 | Body 1900 | e' | 51.4792 | Relative Permittivity ($\epsilon_r$): | 51.48 | 53.30 | -3.42 | 5 |
| | | e" | 14.5687 | Conductivity (σ): | 1.54 | 1.52 | 1.26 | 5 |
| | Body 1850 | e' | 51.6422 | Relative Permittivity ($\epsilon_r$): | 51.64 | 53.30 | -3.11 | 5 |
| | | e" | 14.3961 | Conductivity (σ): | 1.48 | 1.52 | -2.57 | 5 |
| | Body 1880 | e' | 51.5438 | Relative Permittivity ($\epsilon_r$): | 51.54 | 53.30 | -3.29 | 5 |
| | | e" | 14.5009 | Conductivity (σ): | 1.52 | 1.52 | -0.27 | 5 |
| | Body 1910 | e' | 51.4439 | Relative Permittivity ($\epsilon_r$): | 51.44 | 53.30 | -3.48 | 5 |
| | | e" | 14.5996 | Conductivity (σ): | 1.55 | 1.52 | 2.01 | 5 |
| 11/4/2011 | Body 835 | e' | 53.2708 | Relative Permittivity (εr): | 53.27 | 55.20 | -3.49 | 5 |
| | | e" | 21.0356 | Conductivity (σ): | 0.98 | 0.97 | 0.69 | 5 |
| | Body 820 | e' | 53.4326 | Relative Permittivity (εr): | 53.43 | 55.28 | -3.34 | 5 |
| | | e" | 21.0983 | Conductivity (σ): | 0.96 | 0.97 | -0.67 | 5 |
| | Body 850 | e' | 53.1237 | Relative Permittivity (εr): | 53.12 | 55.16 | -3.69 | 5 |
| | | e" | 20.9776 | Conductivity (σ): | 0.99 | 0.99 | 0.44 | 5 |
| 11/4/2011 | Body 1900 | e' | 51.5883 | Relative Permittivity ($\epsilon_r$): | 51.59 | 53.30 | -3.21 | 5 |
| | | e" | 14.5072 | Conductivity (σ): | 1.53 | 1.52 | 0.83 | 5 |
| | Body 1850 | e' | 51.7657 | Relative Permittivity ($\epsilon_r$): | 51.77 | 53.30 | -2.88 | 5 |
| | | e" | 14.3464 | Conductivity (σ): | 1.48 | 1.52 | -2.91 | 5 |
| | Body 1880 | e' | 51.6539 | Relative Permittivity ($\epsilon_r$): | 51.65 | 53.30 | -3.09 | 5 |
| | | e" | 14.4425 | Conductivity (σ): | 1.51 | 1.52 | -0.68 | 5 |
| | Body 1910 | e' | 51.5554 | Relative Permittivity ($\epsilon_r$): | 51.56 | 53.30 | -3.27 | 5 |
| | | e" | 14.5422 | Conductivity (σ): | 1.54 | 1.52 | 1.61 | 5 |

Liquid Check Results (continued)

| Date | Freq. (MHz) | Liquid Parameters | | | Measured | Target | Delta (%) | Limit ±(%) |
|---|---|---|---|---|---|---|---|---|
| 11/29/2011 | Body 1900 | e' | 51.9591 | Relative Permittivity ($\epsilon_r$): | 51.96 | 53.30 | -2.52 | 5 |
| | | e" | 14.2645 | Conductivity (σ): | 1.51 | 1.52 | -0.86 | 5 |
| | Body 1850 | e' | 52.1382 | Relative Permittivity ($\epsilon_r$): | 52.14 | 53.30 | -2.18 | 5 |
| | | e" | 14.1004 | Conductivity (σ): | 1.45 | 1.52 | -4.58 | 5 |
| | Body 1880 | e' | 52.0260 | Relative Permittivity ($\epsilon_r$): | 52.03 | 53.30 | -2.39 | 5 |
| | | e" | 14.1985 | Conductivity (σ): | 1.48 | 1.52 | -2.35 | 5 |
| | Body 1910 | e' | 51.9265 | Relative Permittivity ($\epsilon_r$): | 51.93 | 53.30 | -2.58 | 5 |
| | | e" | 14.2967 | Conductivity (σ): | 1.52 | 1.52 | -0.11 | 5 |
| 11/29/2011 | Body 835 | e' | 55.2718 | Relative Permittivity (εr): | 55.27 | 55.20 | 0.13 | 5 |
| | | e" | 21.1392 | Conductivity (σ): | 0.98 | 0.97 | 1.18 | 5 |
| | Body 820 | e' | 55.4251 | Relative Permittivity (εr): | 55.43 | 55.28 | 0.27 | 5 |
| | | e" | 21.1988 | Conductivity (σ): | 0.97 | 0.97 | -0.20 | 5 |
| | Body 830 | e' | 55.3208 | Relative Permittivity (εr): | 55.32 | 55.24 | 0.15 | 5 |
| | | e" | 21.1595 | Conductivity (σ): | 0.98 | 0.97 | 0.75 | 5 |
| | Body 850 | e' | 55.1233 | Relative Permittivity (εr): | 55.12 | 55.16 | -0.06 | 5 |
| | | e" | 21.0765 | Conductivity (σ): | 1.00 | 0.99 | 0.91 | 5 |
| 11/30/2011 | Body 750 | e' | 54.3619 | Relative Permittivity ($\epsilon_r$): | 54.36 | 55.55 | -2.13 | 5 |
| | | e" | 22.2527 | Conductivity (σ): | 0.93 | 0.96 | -3.64 | 5 |
| | Body 779.5 | e' | 54.3619 | Relative Permittivity ($\epsilon_r$): | 54.36 | 55.45 | -1.96 | 5 |
| | | e" | 22.2527 | Conductivity (σ): | 0.96 | 0.97 | -0.05 | 5 |
| | Body 782 | e' | 54.3619 | Relative Permittivity ($\epsilon_r$): | 54.36 | 55.43 | -1.93 | 5 |
| | | e" | 22.2527 | Conductivity (σ): | 0.97 | 0.97 | 0.23 | 5 |
| | Body 784.5 | e' | 54.3619 | Relative Permittivity ($\epsilon_r$): | 54.36 | 55.43 | -1.93 | 5 |
| | | e" | 22.2527 | Conductivity (σ): | 0.97 | 0.97 | 0.55 | 5 |
| 1/10/2012 | Body 1900 | e' | 51.0687 | Relative Permittivity ($\epsilon_r$): | 51.07 | 53.30 | -4.19 | 5 |
| | | e" | 14.2951 | Conductivity (σ): | 1.51 | 1.52 | -0.64 | 5 |
| | Body 1850 | e' | 51.2362 | Relative Permittivity ($\epsilon_r$): | 51.24 | 53.30 | -3.87 | 5 |
| | | e" | 14.1153 | Conductivity (σ): | 1.45 | 1.52 | -4.47 | 5 |
| | Body 1880 | e' | 51.1342 | Relative Permittivity ($\epsilon_r$): | 51.13 | 53.30 | -4.06 | 5 |
| | | e" | 14.2262 | Conductivity (σ): | 1.49 | 1.52 | -2.16 | 5 |
| | Body 1910 | e' | 51.0328 | Relative Permittivity ($\epsilon_r$): | 51.03 | 53.30 | -4.25 | 5 |
| | | e" | 14.3262 | Conductivity (σ): | 1.52 | 1.52 | 0.10 | 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 Verification

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 validation dipole | Serial No. | Cal. date | Cal. Freq. (GHz) | SAR Avg (mW/g) | | |
|---|---|---|---|---|---|---|
| | | | | Tissue: | Head | Body |
| D750V3 | 1019 | 12/16/10 | 0.75 | 1g SAR: | 8.16 | 8.64 |
| | | | | 10g SAR: | 5.32 | 5.72 |
| D835V2 | 4d117 | 4/15/11 | 0.835 | 1g SAR: | 9.64 | 10.1 |
| | | | | 10g SAR: | 6.28 | 6.60 |
| D1900V2 | 5d140 | 4/18/11 | 1.9 | 1g SAR: | 41.6 | 41.2 |
| | | | | 10g SAR: | 21.5 | 21.6 |
| D2450V2 | 706 | 4/19/11 | 2.45 | 1g SAR: | 51.6 | 52.4 |
| | | | | 10g SAR: | 24.4 | 24.5 |
| D5GHzV2 | 1003 | 8/23/11 | 5200 | 1g SAR: | 76.5 | 74.5 |
| | | | | 10g SAR: | 21.8 | 20.8 |
| | | | 5500 | 1g SAR: | 80.9 | 80.0 |
| | | | | 10g SAR: | 23.1 | 22.3 |
| | | | 5800 | 1g SAR: | 76.3 | 76.3 |
| | | | | 10g SAR: | 21.7 | 21.2 |

## 12.1. System Check Results

| Date Tested | System validation dipole | | Measured (Normalized to 1 W) | | Target | Delta (%) | Tolerance (%) |
|---|---|---|---|---|---|---|---|
| 10/10/11 | Body | 2450 | 1g SAR: | 52.4 | 52.4 | 0.00 | ±10 |
| | | | 10g SAR: | 24.4 | 24.5 | -0.41 | |
| 10/10/11 | Body | 5200 | 1g SAR: | 74.1 | 74.5 | -0.54 | ±10 |
| | | | 10g SAR: | 21.3 | 20.8 | 2.40 | |
| 10/11/11 | Body | 2450 | 1g SAR: | 52.5 | 52.4 | 0.19 | ±10 |
| | | | 10g SAR: | 24.8 | 24.5 | 1.22 | |
| 10/11/11 | Body | 5800 | 1g SAR: | 70.6 | 76.3 | -7.47 | ±10 |
| | | | 10g SAR: | 19.9 | 21.2 | -6.13 | |
| 10/11/11 | Body | 5200 | 1g SAR: | 76.1 | 74.5 | 2.15 | ±10 |
| | | | 10g SAR: | 22.0 | 20.8 | 5.77 | |
| 10/12/11 | Body | 5500 | 1g SAR: | 85.8 | 80 | 7.25 | ±10 |
| | | | 10g SAR: | 24.2 | 22.3 | 8.52 | |
| 10/12/11 | Body | 5800 | 1g SAR: | 73.1 | 76.3 | -4.19 | ±10 |
| | | | 10g SAR: | 20.7 | 21.2 | -2.36 | |
| 10/12/11 | Body | 5200 | 1g SAR: | 75.4 | 74.5 | 1.21 | ±10 |
| | | | 10g SAR: | 21.4 | 20.8 | 2.88 | |
| 10/12/11 | Body | 5500 | 1g SAR: | 83.8 | 80 | 4.75 | ±10 |
| | | | 10g SAR: | 24.1 | 22.3 | 8.07 | |
| 10/24/11 | Body | 5200 | 1g SAR: | 73.4 | 74.5 | -1.48 | ±10 |
| | | | 10g SAR: | 20.7 | 20.8 | -0.48 | |
| 10/24/11 | Body | 5500 | 1g SAR: | 78.2 | 80 | -2.25 | ±10 |
| | | | 10g SAR: | 22.0 | 22.3 | -1.35 | |
| 10/24/11 | Body | 1900 | 1g SAR: | 41.7 | 41.2 | 1.21 | ±10 |
| | | | 10g SAR: | 21.9 | 21.6 | 1.39 | |
| 10/25/11 | Body | 2450 | 1g SAR: | 49.9 | 52.4 | -4.77 | ±10 |
| | | | 10g SAR: | 23.4 | 24.5 | -4.49 | |
| 10/25/11 | Body | 835 | 1g SAR: | 9.54 | 10.1 | -5.54 | ±10 |
| | | | 10g SAR: | 6.29 | 6.6 | -4.70 | |
| 10/25/11 | Body | 1900 | 1g SAR: | 40.2 | 41.2 | -2.43 | ±10 |
| | | | 10g SAR: | 21.2 | 21.6 | -1.85 | |
| 10/26/11 | Body | 835 | 1g SAR: | 9.59 | 10.1 | -5.05 | ±10 |
| | | | 10g SAR: | 6.31 | 6.6 | -4.39 | |
| 10/26/11 | Body | 1900 | 1g SAR: | 42.6 | 41.2 | 3.40 | ±10 |
| | | | 10g SAR: | 22.3 | 21.6 | 3.24 | |
| 10/27/11 | Body | 835 | 1g SAR: | 9.84 | 10.1 | -2.57 | ±10 |
| | | | 10g SAR: | 6.49 | 6.6 | -1.67 | |
| 10/27/11 | Body | 1900 | 1g SAR: | 41.8 | 41.2 | 1.46 | ±10 |
| | | | 10g SAR: | 21.8 | 21.6 | 0.93 | |
| 10/28/11 | Body | 835 | 1g SAR: | 9.5 | 10.1 | -5.74 | ±10 |
| | | | 10g SAR: | 6.3 | 6.6 | -4.85 | |
| 10/28/11 | Body | 1900 | 1g SAR: | 41.4 | 41.2 | 0.49 | ±10 |
| | | | 10g SAR: | 21.8 | 21.6 | 0.93 | |
| 10/31/11 | Body | 835 | 1g SAR: | 9.8 | 10.1 | -2.97 | ±10 |
| | | | 10g SAR: | 6.5 | 6.6 | -2.12 | |

System Check Results (continued)

| Date Tested | System validation dipole | | Measured (Normalized to 1 W) | | Target | Delta (%) | Tolerance (%) |
|---|---|---|---|---|---|---|---|
| 10/31/11 | Body | 1900 | 1g SAR: | 43.3 | 41.2 | 5.10 | ±10 |
| | | | 10g SAR: | 22.6 | 21.6 | 4.63 | |
| 11/01/11 | Body | 750 | 1g SAR: | 8.62 | 8.64 | -0.23 | ±10 |
| | | | 10g SAR: | 5.72 | 5.72 | 0.00 | |
| 11/01/11 | Body | 1900 | 1g SAR: | 43.6 | 41.2 | 5.83 | ±10 |
| | | | 10g SAR: | 22.7 | 21.6 | 5.09 | |
| 11/02/11 | Body | 750 | 1g SAR: | 8.55 | 8.64 | -1.04 | ±10 |
| | | | 10g SAR: | 5.67 | 5.72 | -0.87 | |
| 11/02/11 | Body | 1900 | 1g SAR: | 40.1 | 41.2 | -2.67 | ±10 |
| | | | 10g SAR: | 20.9 | 21.6 | -3.24 | |
| 11/03/11 | Body | 750 | 1g SAR: | 8.5 | 8.64 | -1.62 | ±10 |
| | | | 10g SAR: | 5.64 | 5.72 | -1.40 | |
| 11/03/11 | Body | 1900 | 1g SAR: | 40.0 | 41.2 | -2.91 | ±10 |
| | | | 10g SAR: | 20.9 | 21.6 | -3.24 | |
| 11/04/11 | Body | 835 | 1g SAR: | 10.2 | 10.1 | 0.99 | ±10 |
| | | | 10g SAR: | 6.7 | 6.6 | 1.67 | |
| 11/04/11 | Body | 1900 | 1g SAR: | 41.5 | 41.2 | 0.73 | ±10 |
| | | | 10g SAR: | 21.4 | 21.6 | -0.93 | |
| 11/29/11 | Body | 1900 | 1g SAR: | 41.6 | 41.2 | 0.97 | ±10 |
| | | | 10g SAR: | 21.7 | 21.6 | 0.46 | |
| 11/29/11 | Body | 835 | 1g SAR: | 9.9 | 10.1 | -1.98 | ±10 |
| | | | 10g SAR: | 6.5 | 6.6 | -1.52 | |
| 11/30/11 | Body | 750 | 1g SAR: | 8.73 | 8.64 | 1.04 | ±10 |
| | | | 10g SAR: | 5.8 | 5.72 | 1.40 | |
| 11/30/11 | Body | 835 | 1g SAR: | 10.3 | 10.1 | 1.98 | ±10 |
| | | | 10g SAR: | 6.7 | 6.6 | 1.52 | |
| 01/10/12 | Body | 1900 | $SAR_{1g}$: | 41.6 | 41.2 | 0.97 | ±10 |
| | | | $SAR_{10g}$: | 21.6 | 21.6 | 0.00 | |

# 13. SAR Test Results

## 13.1. GSM850

**Test mode reduction considerations**

Since the source-based time-averaged output power for EGPRS mode is lower than that in the GPRS mode, therefore Body SAR test reduction is applicable for this device

| Test position | dist. (mm) | Pwr back-off | Mode | Ch No. | Freq. (MHz) | Avg Pwr (dBm) | SAR (mW/g) 1-g | Note |
|---|---|---|---|---|---|---|---|---|
| Rear | 0 | Yes | GPRS 2 Slot | 128 | 824.2 | 25.6 | **1.170** | |
| | | | | 190 | 836.6 | 25.7 | 1.050 | |
| | | | | 251 | 848.8 | 25.6 | 0.867 | |
| | | | GPRS 1 Slot | 128 | 824.2 | 28.6 | 1.130 | |
| | | | | 190 | 836.6 | 28.6 | 0.929 | |
| | | | | 251 | 848.8 | 28.6 | 0.784 | |
| | | | EGPRS 2 Slot | 128 | 824.2 | 25.3 | 1.020 | |
| | | | | 190 | 836.6 | 25.4 | 0.933 | |
| | | | | 251 | 848.8 | 25.4 | 0.835 | |
| | | | EGPRS 1 Slot | 128 | 824.2 | 27.0 | | 1 |
| | | | | 190 | 836.6 | 27.1 | 0.616 | |
| | | | | 251 | 848.8 | 27.0 | | 1 |

| Test position | dist. (mm) | Pwr back-off | Mode | Ch No. | Freq. (MHz) | Avg Pwr (dBm) | SAR (mW/g) 1-g | Note |
|---|---|---|---|---|---|---|---|---|
| Top | 0 | Yes | GPRS 2 Slot | 128 | 824.2 | 25.6 | | 1 |
| | | | | 190 | 836.6 | 25.7 | 0.627 | |
| | | | | 251 | 848.8 | 25.6 | | 1 |
| Right | 0 | No | GPRS 2 Slot | 128 | 824.2 | 32.4 | | 1 |
| | | | | 190 | 836.6 | 32.5 | 0.394 | |
| | | | | 251 | 848.8 | 32.4 | | 1 |
| Rear | 11 | No | GPRS 2 Slot | 128 | 824.2 | 32.4 | 1.060 | |
| | | | | 190 | 836.6 | 32.5 | 0.929 | |
| | | | | 251 | 848.8 | 32.4 | 0.843 | |
| Top | 14 | No | GPRS 2 Slot | 128 | 824.2 | 32.4 | | 1 |
| | | | | 190 | 836.6 | 32.5 | 0.482 | |
| | | | | 251 | 848.8 | 32.4 | | 1 |
| Top edge/ Right corner at 15° | 0 | No | GPRS 2 Slot | 128 | 824.2 | 32.4 | 0.967 | |
| | | | | 190 | 836.6 | 32.5 | 0.818 | |
| | | | | 251 | 848.8 | 32.4 | 0.690 | |

**Note(s):**

1. SAR test was performed in the middle channel only as the measured level was < 50% of the SAR limit as stated in FCC “Public Notice DA 02-1438” by the SCC-34/SC-2. Testing in the low and high channel is optional.

## 13.2. GSM1900

**Test mode reduction considerations**

Since the source-based time-averaged output power for EGPRS mode is lower than that in the GPRS mode, therefore Body SAR test reduction is applicable for this device

| Test position | dist. (mm) | Pwr back-off | Mode | Ch No. | Freq. (MHz) | Avg Pwr (dBm) | SAR (mW/g) 1-g | Note |
|---|---|---|---|---|---|---|---|---|
| Rear | 0 | Yes | GPRS 2 Slot | 512 | 1850.2 | 22.2 | 0.782 | |
| | | | | 661 | 1880.0 | 22.3 | 0.851 | |
| | | | | 810 | 1909.8 | 22.3 | **1.010** | |
| Rear | 0 | Yes | GPRS 1 Slot | 512 | 1850.2 | 25.3 | 0.803 | |
| | | | | 661 | 1880.0 | 25.3 | 0.830 | |
| | | | | 810 | 1909.8 | 25.3 | 1.010 | |
| Rear | 0 | Yes | EGPRS 2 Slot | 512 | 1850.2 | 22.1 | 0.771 | |
| | | | | 661 | 1880.0 | 22.2 | 0.810 | |
| | | | | 810 | 1909.8 | 22.2 | 0.957 | |
| Rear | 0 | Yes | EGPRS 1 Slot | 512 | 1850.2 | 25.3 | 0.758 | |
| | | | | 661 | 1880.0 | 25.3 | 0.802 | |
| | | | | 810 | 1909.8 | 25.3 | 0.967 | |

| Test position | dist. (mm) | Pwr back-off | Mode | Ch No. | Freq. (MHz) | Avg Pwr (dBm) | SAR (mW/g) 1-g | Note |
|---|---|---|---|---|---|---|---|---|
| Top | 0 | Yes | GPRS 2 Slot | 512 | 1850.2 | 22.2 | | 1 |
| | | | | 661 | 1880.0 | 22.3 | 0.598 | |
| | | | | 810 | 1909.8 | 22.3 | | 1 |
| Right | 0 | No | GPRS 2 Slot | 512 | 1850.2 | 28.0 | | 1 |
| | | | | 661 | 1880.0 | 28.1 | 0.276 | |
| | | | | 810 | 1909.8 | 28.2 | | 1 |
| Rear | 11 | No | GPRS 2 Slot | 512 | 1850.2 | 28.0 | | 1 |
| | | | | 661 | 1880.0 | 28.1 | 0.788 | |
| | | | | 810 | 1909.8 | 28.2 | | 1 |
| Top | 14 | No | GPRS 2 Slot | 512 | 1850.2 | 28.0 | | 1 |
| | | | | 661 | 1880.0 | 28.1 | 0.420 | |
| | | | | 810 | 1909.8 | 28.2 | | 1 |
| Top edge/ Right corner at 15° | 0 | No | GPRS 2 Slot | 512 | 1850.2 | 28.0 | | 1 |
| | | | | 661 | 1880.0 | 28.1 | 0.424 | |
| | | | | 810 | 1909.8 | 28.2 | | 1 |

**Note(s):**

1. SAR test was performed in the middle channel only as the measured level was < 50% of the SAR limit as stated in FCC “Public Notice DA 02-1438” by the SCC-34/SC-2. Testing in the low and high channel is optional.

## 13.3. UMTS (WCDMA) Band V

**Test mode reduction considerations**

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

| Test position | dist. (mm) | Pwr back-off | Mode | Ch No. | Freq. (MHz) | Avg Pwr (dBm) | SAR (mW/g) 1-g | Note |
|---|---|---|---|---|---|---|---|---|
| Rear | 0 | Yes | Rel 99 | 4357 | 826.4 | 20.0 | 1.160 | |
| | | | | 4408 | 836.6 | 20.1 | **1.180** | |
| | | | | 4458 | 846.6 | 19.9 | 1.120 | |
| Top | 0 | Yes | Rel 99 | 4357 | 826.4 | 20.0 | | 1 |
| | | | | 4408 | 836.6 | 20.1 | 0.729 | |
| | | | | 4458 | 846.6 | 19.9 | | 1 |
| Right | 0 | No | Rel 99 | 4357 | 826.4 | 24.9 | | 1 |
| | | | | 4408 | 836.6 | 25.0 | 0.316 | |
| | | | | 4458 | 846.6 | 24.8 | | 1 |
| Rear | 11 | No | Rel 99 | 4357 | 826.4 | 24.9 | 0.884 | |
| | | | | 4408 | 836.6 | 25.0 | 0.910 | |
| | | | | 4458 | 846.6 | 24.8 | 0.846 | |
| Top | 14 | No | Rel 99 | 4357 | 826.4 | 24.9 | | 1 |
| | | | | 4408 | 836.6 | 25.0 | 0.430 | |
| | | | | 4458 | 846.6 | 24.8 | | 1 |
| Top edge/ Right corner at 15° | 0 | No | Rel 99 | 4357 | 826.4 | 24.9 | | 1 |
| | | | | 4408 | 836.6 | 25.0 | 0.753 | |
| | | | | 4458 | 846.6 | 24.8 | | 1 |

**Note(s):**

1. SAR test was performed in the middle channel only as the measured level was < 50% of the SAR limit as stated in FCC “Public Notice DA 02-1438” by the SCC-34/SC-2. Testing in the low and high channel is optional.

## 13.4. UMTS (WCDMA) 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) | Pwr back-off | Mode | Ch No. | Freq. (MHz) | Avg Pwr (dBm) | SAR (mW/g) 1-g | Note |
|---|---|---|---|---|---|---|---|---|
| Rear | 0 | Yes | Rel 99 | 9662 | 1852.4 | 15.5 | 1.090 | |
| | | | | 9800 | 1880.0 | 15.6 | **1.180** | |
| | | | | 9938 | 1907.6 | 15.7 | 1.140 | |
| Top | 0 | Yes | Rel 99 | 9662 | 1852.4 | 15.5 | 0.900 | |
| | | | | 9800 | 1880.0 | 15.6 | 0.850 | |
| | | | | 9938 | 1907.6 | 15.7 | 0.789 | |
| Right | 0 | No | Rel 99 | 9662 | 1852.4 | 22.8 | | 1 |
| | | | | 9800 | 1880.0 | 23.0 | 0.458 | |
| | | | | 9938 | 1907.6 | 22.8 | | 1 |
| Rear | 11 | No | Rel 99 | 9662 | 1852.4 | 22.8 | 0.883 | |
| | | | | 9800 | 1880.0 | 23.0 | 1.000 | |
| | | | | 9938 | 1907.6 | 22.8 | 1.050 | |
| Top | 14 | No | Rel 99 | 9662 | 1852.4 | 22.8 | 0.648 | |
| | | | | 9800 | 1880.0 | 23.0 | 0.808 | |
| | | | | 9938 | 1907.6 | 22.8 | 0.917 | |
| Top edge/ Right corner at 15° | 0 | No | Rel 99 | 9662 | 1852.4 | 22.8 | | 1 |
| | | | | 9800 | 1880.0 | 23.0 | 0.758 | |
| | | | | 9938 | 1907.6 | 22.8 | | 1 |
| Top edge/ Rear corner at 41° | 0 | Yes | Rel 99 | 9262 | 1852.4 | 14.9 | 1.090 | |
| | | | | 9400 | 1880.0 | 14.8 | 1.160 | |
| | | | | 9538 | 1907.6 | 15.0 | 1.060 | |

**Note(s):**

1. SAR test was performed in the middle channel only as the measured level was < 50% of the SAR limit as stated in FCC "Public Notice DA 02-1438" by the SCC-34/SC-2. Testing in the low and high channel is optional.

## 13.5. CDMA BC0

**Test mode reduction considerations**

SAR for Subtype 2 Physical layer configurations in not required for Rev. A since the maximum average output of each RF channel is less than that measured in Subtype 0/1 Physical layer configurations as per KDB 941225 D01 SAR test for 3G devices v02.

| Test position | dist. (mm) | Pwr back-off | Mode | Ch No. | Freq. (MHz) | Avg Pwr (dBm) | SAR (mW/g) 1-g | Note |
|---|---|---|---|---|---|---|---|---|
| Rear | 0 | Yes | 1xRTT (RC3,SO32) | 1013 | 824.7 | 19.9 | 1.190 | |
| | | | | 384 | 836.5 | 20.0 | **1.190** | |
| | | | | 777 | 848.3 | 20.0 | 1.130 | |
| Top | 0 | Yes | 1xRTT (RC3,SO32) | 1013 | 824.7 | 19.9 | | |
| | | | | 384 | 836.5 | 20.0 | 0.772 | |
| | | | | 777 | 848.3 | 20.0 | | |
| Right | 0 | No | 1xRTT (RC3,SO32) | 1013 | 824.7 | 24.7 | | 1 |
| | | | | 384 | 836.5 | 24.7 | 0.327 | |
| | | | | 777 | 848.3 | 24.7 | | 1 |
| Rear | 11 | No | 1xRTT (RC3,SO32) | 1013 | 824.7 | 24.7 | 0.937 | |
| | | | | 384 | 836.5 | 24.7 | 0.938 | |
| | | | | 777 | 848.3 | 24.7 | 0.899 | |
| Top | 14 | No | 1xRTT (RC3,SO32) | 1013 | 824.7 | 24.7 | | 1 |
| | | | | 384 | 836.5 | 24.7 | 0.394 | |
| | | | | 777 | 848.3 | 24.7 | | 1 |
| Top edge/ Right corner at 15° | 0 | No | 1xRTT (RC3,SO32) | 1013 | 824.7 | 24.7 | | 1 |
| | | | | 384 | 836.5 | 24.7 | 0.734 | |
| | | | | 777 | 848.3 | 24.7 | | 1 |

| Test position | dist. (mm) | Pwr back-off | Mode | Ch No. | Freq. (MHz) | Avg Pwr (dBm) | SAR (mW/g) 1-g | Note |
|---|---|---|---|---|---|---|---|---|
| Rear | 0 | Yes | 1x EV-DO Release 0 | 1013 | 824.7 | 20.0 | 1.170 | |
| | | | | 384 | 836.5 | 19.9 | **1.190** | |
| | | | | 777 | 848.3 | 20.0 | 1.140 | |
| Top | 0 | Yes | 1x EV-DO Release 0 | 1013 | 824.7 | 20.0 | | 1 |
| | | | | 384 | 836.5 | 19.9 | 0.722 | |
| | | | | 777 | 848.3 | 20.0 | | 1 |
| Right | 0 | No | 1x EV-DO Release 0 | 1013 | 824.7 | 24.7 | | 1 |
| | | | | 384 | 836.5 | 24.7 | 0.310 | |
| | | | | 777 | 848.3 | 24.6 | | 1 |
| Rear | 11 | No | 1x EV-DO Release 0 | 1013 | 824.7 | 24.7 | 0.826 | |
| | | | | 384 | 836.5 | 24.7 | 0.823 | |
| | | | | 777 | 848.3 | 24.6 | 0.817 | |
| Top | 14 | No | 1x EV-DO Release 0 | 1013 | 824.7 | 24.7 | | 1 |
| | | | | 384 | 836.5 | 24.7 | 0.355 | |
| | | | | 777 | 848.3 | 24.6 | | 1 |
| Top edge/ Right corner at 15° | 0 | No | 1x EV-DO Release 0 | 1013 | 824.7 | 24.7 | 0.807 | |
| | | | | 384 | 836.5 | 24.7 | 0.790 | |
| | | | | 777 | 848.3 | 24.6 | 0.768 | |

**Note(s):**

1. SAR test was performed in the middle channel only as the measured level was < 50% of the SAR limit as stated in FCC “Public Notice DA 02-1438” by the SCC-34/SC-2. Testing in the low and high channel is optional.

## 13.6. CDMA BC1

**Test mode reduction considerations**

SAR for Subtype 2 Physical layer configurations in not required for Rev. A since the maximum average output of each RF channel is less than that measured in Subtype 0/1 Physical layer configurations as per KDB 941225 D01 SAR test for 3G devices v02.

| Test position | dist. (mm) | Pwr back-off | Mode | Ch No. | Freq. (MHz) | Avg Pwr (dBm) | SAR (mW/g) 1-g | Note |
|---|---|---|---|---|---|---|---|---|
| Rear | 0 | Yes | 1xRTT (RC3,SO32) | 25 | 1851.3 | 15.5 | 0.917 | |
| | | | | 600 | 1880.0 | 15.5 | 0.984 | |
| | | | | 1175 | 1908.8 | 15.5 | **1.080** | |
| Top | 0 | Yes | 1xRTT (RC3,SO32) | 25 | 1851.3 | 15.5 | | |
| | | | | 600 | 1880.0 | 15.5 | 0.639 | |
| | | | | 1175 | 1908.8 | 15.5 | | |
| Right | 0 | No | 1xRTT (RC3,SO32) | 25 | 1851.3 | 22.9 | | 1 |
| | | | | 600 | 1880.0 | 23.0 | 0.507 | |
| | | | | 1175 | 1908.8 | 23.0 | | 1 |
| Rear | 11 | No | 1xRTT (RC3,SO32) | 25 | 1851.3 | 22.9 | 0.753 | |
| | | | | 600 | 1880.0 | 23.0 | 0.847 | |
| | | | | 1175 | 1908.8 | 23.0 | 0.948 | |
| Top | 14 | No | 1xRTT (RC3,SO32) | 25 | 1851.3 | 22.9 | | 1 |
| | | | | 600 | 1880.0 | 23.0 | 0.782 | |
| | | | | 1175 | 1908.8 | 23.0 | | 1 |
| Top edge/ Right corner at 15° | 0 | No | 1xRTT (RC3,SO32) | 25 | 1851.3 | 22.9 | | 1 |
| | | | | 600 | 1880.0 | 23.0 | 0.720 | |
| | | | | 1175 | 1908.8 | 23.0 | | 1 |

| Test position | dist. (mm) | Pwr back-off | Mode | Ch No. | Freq. (MHz) | Avg Pwr (dBm) | SAR (mW/g) 1-g | Note |
|---|---|---|---|---|---|---|---|---|
| Rear | 0 | Yes | 1x EV-DO Release 0 | 25 | 1851.3 | 15.5 | 0.845 | |
| | | | | 600 | 1880.0 | 15.5 | 0.933 | |
| | | | | 1175 | 1908.8 | 15.5 | **1.040** | |
| Top | 0 | Yes | 1x EV-DO Release 0 | 25 | 1851.3 | 15.5 | | |
| | | | | 600 | 1880.0 | 15.5 | 0.604 | |
| | | | | 1175 | 1908.8 | 15.5 | | |
| Right | 0 | No | 1x EV-DO Release 0 | 25 | 1851.3 | 22.9 | | 1 |
| | | | | 600 | 1880.0 | 23.0 | 0.527 | |
| | | | | 1175 | 1908.8 | 22.9 | | 1 |
| Rear | 11 | No | 1x EV-DO Release 0 | 25 | 1851.3 | 22.9 | 0.738 | |
| | | | | 600 | 1880.0 | 23.0 | 0.837 | |
| | | | | 1175 | 1908.8 | 22.9 | 0.945 | |
| Top | 14 | No | 1x EV-DO Release 0 | 25 | 1851.3 | 22.9 | | 1 |
| | | | | 600 | 1880.0 | 23.0 | 0.751 | |
| | | | | 1175 | 1908.8 | 22.9 | | 1 |
| Top edge/ Right corner at 15° | 0 | No | 1x EV-DO Release 0 | 25 | 1851.3 | 22.9 | | 1 |
| | | | | 600 | 1880.0 | 23.0 | 0.723 | |
| | | | | 1175 | 1908.8 | 22.9 | | 1 |

**Note(s):**

1. SAR test was performed in the middle channel only as the measured level was < 50% of the SAR limit as stated in FCC “Public Notice DA 02-1438” by the SCC-34/SC-2. Testing in the low and high channel is optional.

## 13.7. LTE Band 13

**Test mode reduction considerations**

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.

**10MHz Channel Bandwidth**

| Test position | dist. (mm) | Pwr back-off | Mode | Ch # | Freq. (MHz) | RB SIze | RB Offset | MPR | Avg Pwr (dBm) | SAR (mW/g) 1-g | Note |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Rear | 0 | Yes | QPSK | 23230 | 782.0 | 25 | 12 | 1 | 18.9 | **1.140** | |
| | | | | | | 1 | 0 | 0 | 18.9 | 1.130 | |
| | | | | | | 1 | 49 | 0 | 18.9 | 1.090 | |
| | | | | | | 50 | 0 | 1 | 18.9 | 1.110 | |
| | | | 16QAM | 23230 | 782.0 | 25 | 12 | 2 | 18.9 | 1.140 | |
| | | | | | | 1 | 0 | 1 | 19.1 | **1.190** | |
| | | | | | | 1 | 49 | 1 | 19.0 | 1.150 | |
| | | | | | | 50 | 0 | 2 | 18.9 | 1.150 | |
| Top | 0 | Yes | QPSK | 23230 | 782.0 | 25 | 12 | 1 | 18.9 | 0.736 | |
| | | | | | | 1 | 0 | 0 | 18.9 | 0.750 | |
| | | | | | | 1 | 49 | 0 | 18.9 | 0.735 | |
| | | | | | | 50 | 0 | 1 | 18.9 | | 1 |
| | | | 16QAM | 23230 | 782.0 | 25 | 12 | 2 | 18.9 | 0.741 | |
| | | | | | | 1 | 0 | 1 | 19.1 | 0.790 | |
| | | | | | | 1 | 49 | 1 | 19.0 | 0.773 | |
| | | | | | | 50 | 0 | 2 | 18.9 | | 1 |
| Right | 0 | No | QPSK | 23230 | 782.0 | 25 | 12 | 1 | 23.5 | 0.382 | |
| | | | | | | 1 | 0 | 0 | 24.4 | 0.473 | |
| | | | | | | 1 | 49 | 0 | 24.3 | 0.443 | |
| | | | | | | 50 | 0 | 1 | 23.3 | | 1 |
| | | | 16QAM | 23230 | 782.0 | 25 | 12 | 2 | 22.4 | 0.301 | |
| | | | | | | 1 | 0 | 1 | 23.6 | 0.391 | |
| | | | | | | 1 | 49 | 1 | 23.5 | 0.372 | |
| | | | | | | 50 | 0 | 2 | 22.5 | | 1 |
| Rear | 11 | No | QPSK | 23230 | 782.0 | 25 | 12 | 1 | 23.5 | 0.635 | |
| | | | | | | 1 | 0 | 0 | 24.4 | 0.765 | |
| | | | | | | 1 | 49 | 0 | 24.3 | 0.780 | |
| | | | | | | 50 | 0 | 1 | 23.3 | | 1 |
| | | | 16QAM | 23230 | 782.0 | 25 | 12 | 2 | 22.4 | 0.499 | |
| | | | | | | 1 | 0 | 1 | 23.6 | 0.646 | |
| | | | | | | 1 | 49 | 1 | 23.5 | 0.655 | |
| | | | | | | 50 | 0 | 2 | 22.5 | | 1 |
| Top | 14 | No | QPSK | 23230 | 782.0 | 25 | 12 | 1 | 23.5 | 0.275 | |
| | | | | | | 1 | 0 | 0 | 24.4 | 0.347 | |
| | | | | | | 1 | 49 | 0 | 24.3 | 0.327 | |
| | | | | | | 50 | 0 | 1 | 23.3 | | 1 |
| | | | 16QAM | 23230 | 782.0 | 25 | 12 | 2 | 22.4 | 0.219 | |
| | | | | | | 1 | 0 | 1 | 23.6 | 0.290 | |
| | | | | | | 1 | 49 | 1 | 23.5 | 0.276 | |
| | | | | | | 50 | 0 | 2 | 22.5 | | 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.

10MHz Channel Bandwidth (continued)

| Test position | dist. (mm) | Pwr back-off | Mode | Ch # | Freq. (MHz) | RB SIze | RB Offset | MPR | Avg Pwr (dBm) | SAR (mW/g) 1-g | Note |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Top edge/ Right corner at 15° | 0 | No | QPSK | 23230 | 782.0 | 25 | 12 | 1 | 23.5 | 0.615 | |
| | | | | | | 1 | 0 | 0 | 24.4 | 0.753 | |
| | | | | | | 1 | 49 | 0 | 24.3 | 0.717 | |
| | | | | | | 50 | 0 | 1 | 23.3 | | 1 |
| | | | 16QAM | 23230 | 782.0 | 25 | 12 | 2 | 22.4 | 0.475 | |
| | | | | | | 1 | 0 | 1 | 23.6 | 0.627 | |
| | | | | | | 1 | 49 | 1 | 23.5 | 0.607 | |
| | | | | | | 50 | 0 | 2 | 22.5 | | 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.

## 13.8. WiFi (802.11abgn)

**802.11bgn (2.4GHz)**

**Test mode reduction considerations**

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

| Test position | dist. (mm) | Pwr back-off | Mode | Ch No. | Freq. (MHz) | Avg Pwr (dBm) | SAR (mW/g) 1-g | Note |
|---|---|---|---|---|---|---|---|---|
| Rear | 0 | N/A | 802.11 b 1Mbps | 1 | 2412.0 | 16.5 | | 1 |
| | | | | 6 | 2437.0 | 16.7 | 0.089 | |
| | | | | 11 | 2462.0 | 16.5 | | 1 |
| bottom | 0 | N/A | 802.11 b 1Mbps | 1 | 2412.0 | 16.5 | 0.924 | |
| | | | | 6 | 2437.0 | 16.7 | 1.180 | |
| | | | | 11 | 2462.0 | 16.5 | **1.190** | |
| Right | 0 | N/A | 802.11 b 1Mbps | 1 | 2412.0 | 16.5 | | 1 |
| | | | | 6 | 2437.0 | 16.7 | 0.049 | |
| | | | | 11 | 2462.0 | 16.5 | | 1 |

**Note(s):**

1. Testing was performed on the channel with the highest output power only as the SAR was ≤ 0.8 W/kg with the operating frequency band having a range of < 100 MHz. Per KDB 447498 1) e) i).

## 802.11an (5GHz)

## Test mode reduction considerations

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

| Test position | dist. (mm) | Pwr back-off | Mode | Ch No. | Freq. (MHz) | Avg Pwr (dBm) | SAR (mW/g) 1-g | Note |
|---|---|---|---|---|---|---|---|---|
| Rear | 0 | N/A | 802.11 a 5.2GHz 6Mbps | 36 | 5180.0 | 13.5 | | 1 |
| | | | | 40 | 5200.0 | 13.5 | 0.045 | |
| | | | | 48 | 5240.0 | 13.5 | | 1 |
| bottom | 0 | N/A | | 36 | 5180.0 | 13.5 | | 1 |
| | | | | 40 | 5200.0 | 13.5 | **0.501** | |
| | | | | 48 | 5240.0 | 13.5 | | 1 |
| Right | 0 | N/A | | 36 | 5180.0 | 13.5 | | 1 |
| | | | | 40 | 5200.0 | 13.5 | 0.043 | |
| | | | | 48 | 5240.0 | 13.5 | | 1 |
| Rear | 0 | N/A | 802.11 a 5.3GHz 6Mbps | 52 | 5260.0 | 17.5 | | 1 |
| | | | | 60 | 5300.0 | 17.5 | 0.117 | |
| | | | | 64 | 5320.0 | 16.5 | | 1 |
| bottom | 0 | N/A | | 52 | 5260.0 | 17.5 | 1.000 | |
| | | | | 60 | 5300.0 | 17.5 | **1.120** | |
| | | | | 64 | 5320.0 | 16.5 | 1.090 | |
| Right | 0 | N/A | | 52 | 5260.0 | 17.5 | | 1 |
| | | | | 60 | 5300.0 | 17.5 | 0.052 | |
| | | | | 64 | 5320.0 | 16.5 | | 1 |
| Rear | 0 | N/A | *802.11 a 5.5GHz 6Mbps | 100 | 5500.0 | 16.5 | | 2 |
| | | | | 120 | 5600.0 | 16.5 | 0.068 | |
| | | | | 140 | 5700.0 | 16.5 | | 2 |
| bottom | 0 | N/A | | 100 | 5500.0 | 16.5 | 0.887 | |
| | | | | 120 | 5600.0 | 16.5 | **1.080** | |
| | | | | 140 | 5700.0 | 16.5 | 0.954 | |
| Right | 0 | N/A | | 100 | 5500.0 | 16.5 | | 2 |
| | | | | 120 | 5600.0 | 16.5 | 0.011 | |
| | | | | 140 | 5700.0 | 16.5 | | 2 |
| Rear | 0 | N/A | 802.11 a 5.8GHz 6Mbps | 149 | 5745.0 | 17.5 | | 1 |
| | | | | 157 | 5785.0 | 17.5 | 0.069 | |
| | | | | 165 | 5825.0 | 17.5 | | 1 |
| bottom | 0 | N/A | | 149 | 5745.0 | 17.5 | **1.150** | |
| | | | | 157 | 5785.0 | 17.5 | 1.040 | |
| | | | | 165 | 5825.0 | 17.5 | 1.140 | |
| Right | 0 | N/A | | 149 | 5745.0 | 17.5 | | 1 |
| | | | | 157 | 5785.0 | 17.5 | 0.019 | |
| | | | | 165 | 5825.0 | 17.5 | | 1 |

**Note(s):**

1. Testing was performed on the channel with the highest output power only as the SAR was ≤ 0.8 W/kg with the operating frequency band having a range of < 100 MHz. Per KDB 447498 1) e) i).
2. Testing was performed on the channel with the highest output power only as the SAR was ≤ 0.4 W/kg with the operating frequency band having a range of ≤ 200 MHz. Per KDB 447498 1) e) ii).
3. ***The FCC has reviewed and accepted the measurements on the non-default channels.**

# 14. Summary of Highest 1g SAR

| FCC rule part | Technology/Band | Test configuration | Mode | Separation distance (mm) | Highest 1g SAR (W/kg) |
|---|---|---|---|---|---|
| 22 | GSM850 | Rear | GPRS 2 slot | 0 | 1.17 |
| | UMTS Band V | Rear | R99 | 0 | 1.18 |
| | CDMA BC0 | Rear | 1xRTT (RC3, SO55) | 0 | 1.19 |
| | | Rear | 1xEVDO (Rel. 0) | 0 | 1.19 |
| 24 | GSM1900 | Rear | GPRS 2 slot | 0 | 1.01 |
| | UMTS Band II | Rear | R99 | 0 | 1.18 |
| | CDMA BC1 | Rear | 1xRTT (RC3, SO55) | 0 | 1.08 |
| | | Rear | 1xEVDO (Rel. 0) | 0 | 1.04 |
| 27 | LTE band 13 | Rear | QPSK (RB 25/12) | 0 | 1.14 |
| | | Rear | 16QAM (RB 25/12) | 0 | 1.19 |
| 15.247 | WiFi 2.4 GHz | Bottom | 802.11b | 0 | 1.19 |
| 15.407 | WiFi 5.2 GHz | Bottom | 802.11a | 0 | 0.501 |
| | WiFi 5.3 GHz | Bottom | 802.11a | 0 | 1.12 |
| | WiFi 5.5 GHz | Bottom | 802.11a | 0 | 1.08 |
| 15.247 | WiFi 5.8 GHz | Bottom | 802.11a | 0 | 1.15 |

# 15. Worst-case SAR Plots

Date/Time: 10/26/2011 12:32:29 AM

Test Laboratory: UL CCS SAR Lab D

## GSM 850

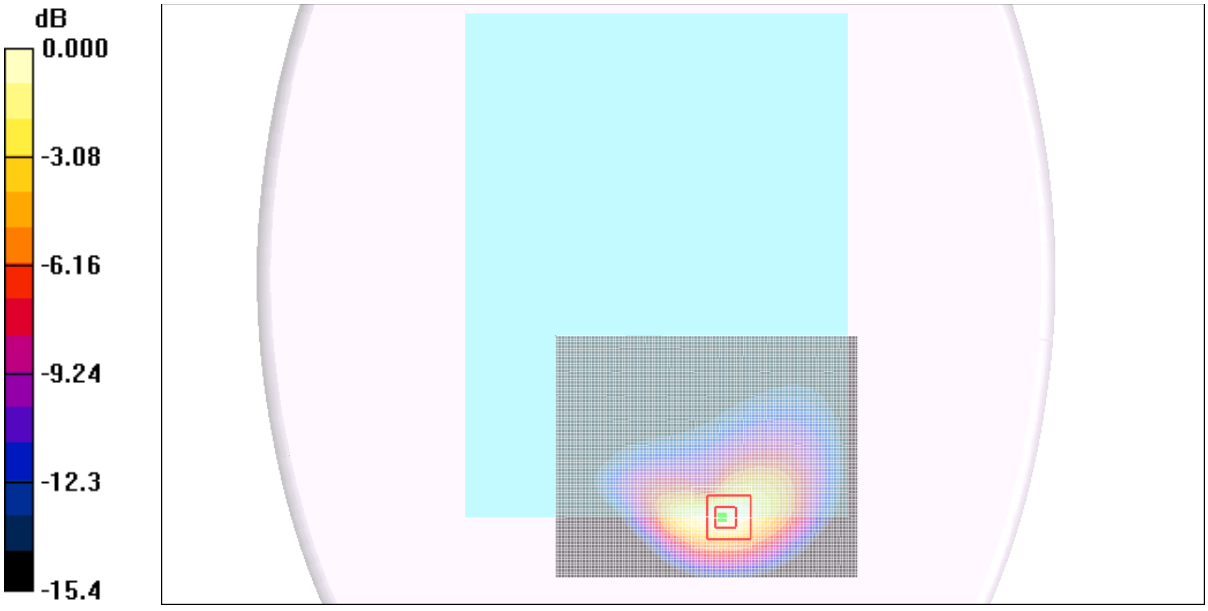
Communication System: GSM850; Frequency: 824.2 MHz; Duty Cycle: 1:4
Medium parameters used: f = 825 MHz; $\sigma$ = 0.947 mho/m; $\varepsilon_r$ = 53.9; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section

Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 deg. C

DASY4 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3749; ConvF(8.79, 8.79, 8.79); Calibrated: 12/13/2010
- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used))Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1259; Calibrated: 5/3/2011
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BB; Serial: 1017
- Measurement SW: DASY4, V4.7 Build 80; Post processing SW: SEMCAD, V1.8 Build 186

**Rear/Base_GPRS 2 slot_L ch/Area Scan (101x81x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.58 mW/g

**Rear/Base_GPRS 2 slot_L ch/Zoom Scan (7x7x9)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 40.4 V/m; Power Drift = -0.122 dB
Peak SAR (extrapolated) = 2.35 W/kg
**SAR(1 g) = 1.17 mW/g; SAR(10 g) = 0.619 mW/g**
Maximum value of SAR (measured) = 1.62 mW/g




0 dB = 1.62mW/g

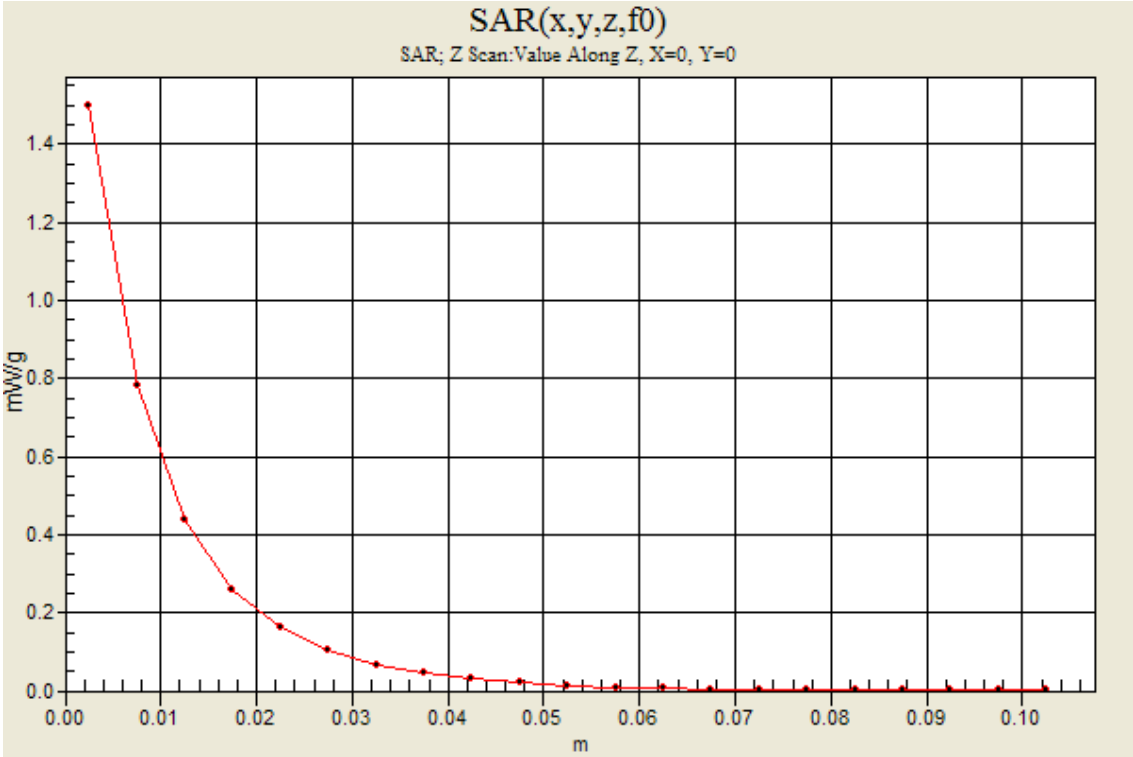
Date/Time: 10/26/2011 12:50:52 AM

Test Laboratory: UL CCS SAR Lab D

## GSM 850

Communication System: GSM850; Frequency: 824.2 MHz; Duty Cycle: 1:4

**Rear/Base_GPRS 2 slot_L ch/Z Scan (1x1x21):** Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 1.50 mW/g



Date: 10/25/2011

Test Laboratory: UL CCS SAR Lab A

## PCS 1900

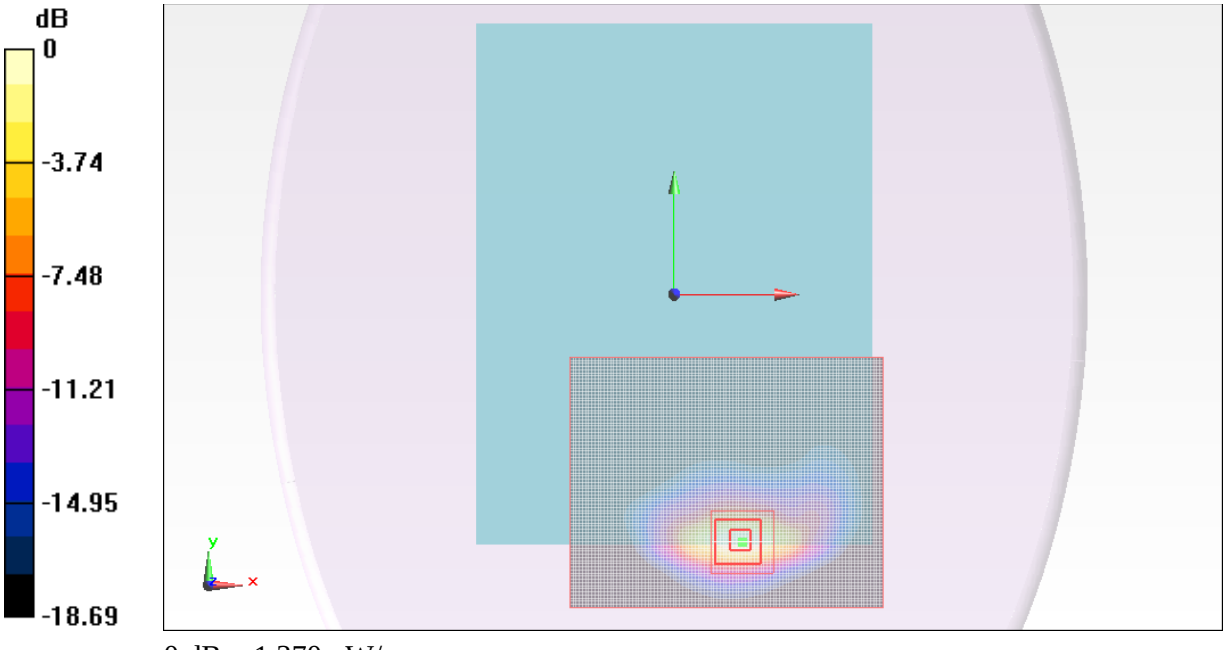
Communication System: GPRS-FDD (TDMA, GMSK, 2 slot); Frequency: 1909.8 MHz; Duty Cycle: 1:4.00037
Medium parameters used: f = 1910 MHz; $\sigma$ = 1.486 mho/m; $\varepsilon_r$ = 51.627; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section

Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 deg. C

DASY5 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3686; ConvF(6.99, 6.99, 6.99); Calibrated: 1/24/2011
- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn500; Calibrated: 7/14/2011
- Phantom: ELI v4.0(A); Type: QDOVA001BB; Serial: 1119
- Measurement SW: DASY52, Version 52.6 (2);SEMCAD X Version 14.4.5 (3634)

**Rear/Base/GPRS 2 slot_H ch/Area Scan (101x81x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.377 mW/g

**Rear/Base/GPRS 2 slot_H ch/Zoom Scan (7x7x9)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 28.196 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 2.018 W/kg
**SAR(1 g) = 1.01 mW/g; SAR(10 g) = 0.480 mW/g**
Maximum value of SAR (measured) = 1.366 mW/g




0 dB = 1.370mW/g

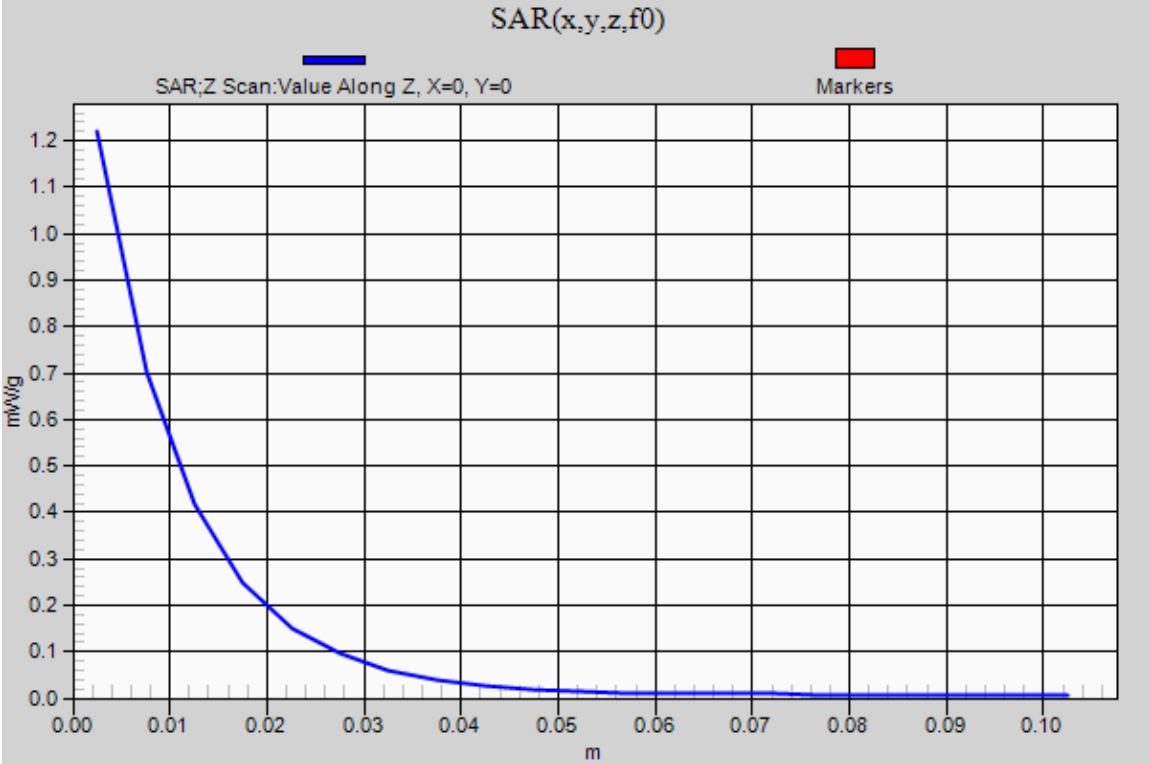
Date: 10/25/2011

Test Laboratory: UL CCS SAR Lab A

## PCS 1900

Communication System: GPRS-FDD (TDMA, GMSK, 2 slot); Frequency: 1909.8 MHz;Duty Cycle: 1:4.00037

**Rear/Base/GPRS 2 slot_H ch/Z Scan (1x1x21):** Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 1.220 mW/g



Date/Time: 10/25/2011 7:43:26 PM

Test Laboratory: UL CCS SAR Lab D

## UMTS band V

Communication System: UMTS Band V; Frequency: 836.6 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 836.6 MHz; $\sigma$ = 0.959 mho/m; $\varepsilon_r$ = 53.8; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section

Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 deg. C

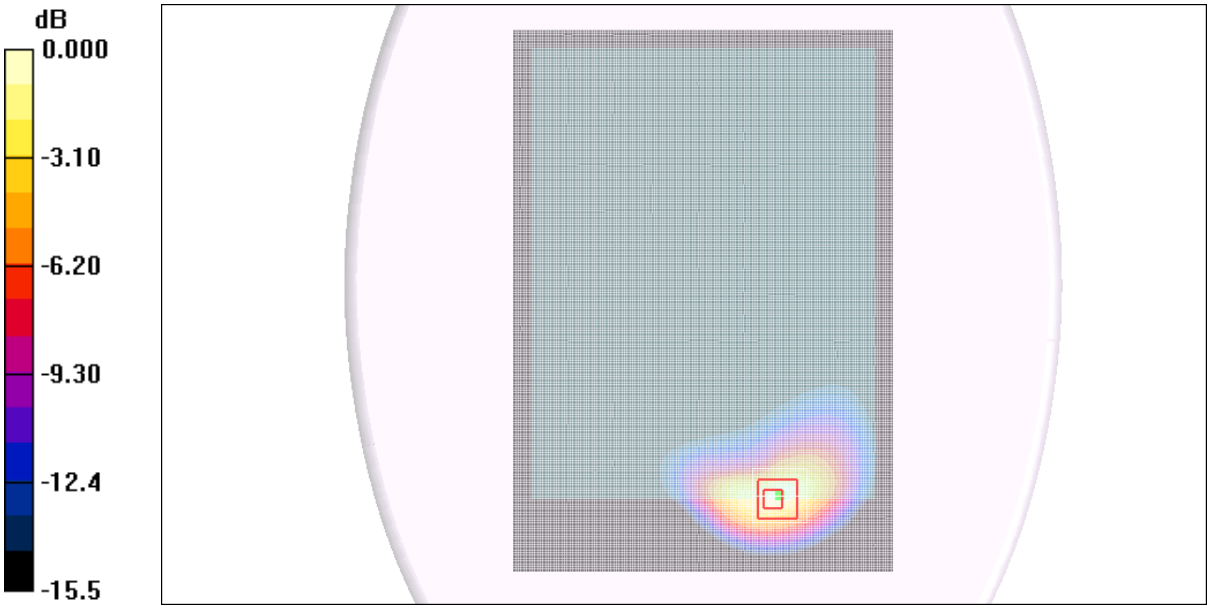
DASY4 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3749; ConvF(8.79, 8.79, 8.79); Calibrated: 12/13/2010
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1259; Calibrated: 5/3/2011
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BB; Serial: 1017
- Measurement SW: DASY4, V4.7 Build 80; Post processing SW: SEMCAD, V1.8 Build 186

### Rear/Base_M ch/Area Scan (141x201x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 1.52 mW/g

### Rear/Base_M ch/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm

Reference Value = 39.9 V/m; Power Drift = 0.026 dB
Peak SAR (extrapolated) = 2.48 W/kg
**SAR(1 g) = 1.18 mW/g; SAR(10 g) = 0.620 mW/g**
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.63 mW/g




0 dB = 1.63mW/g

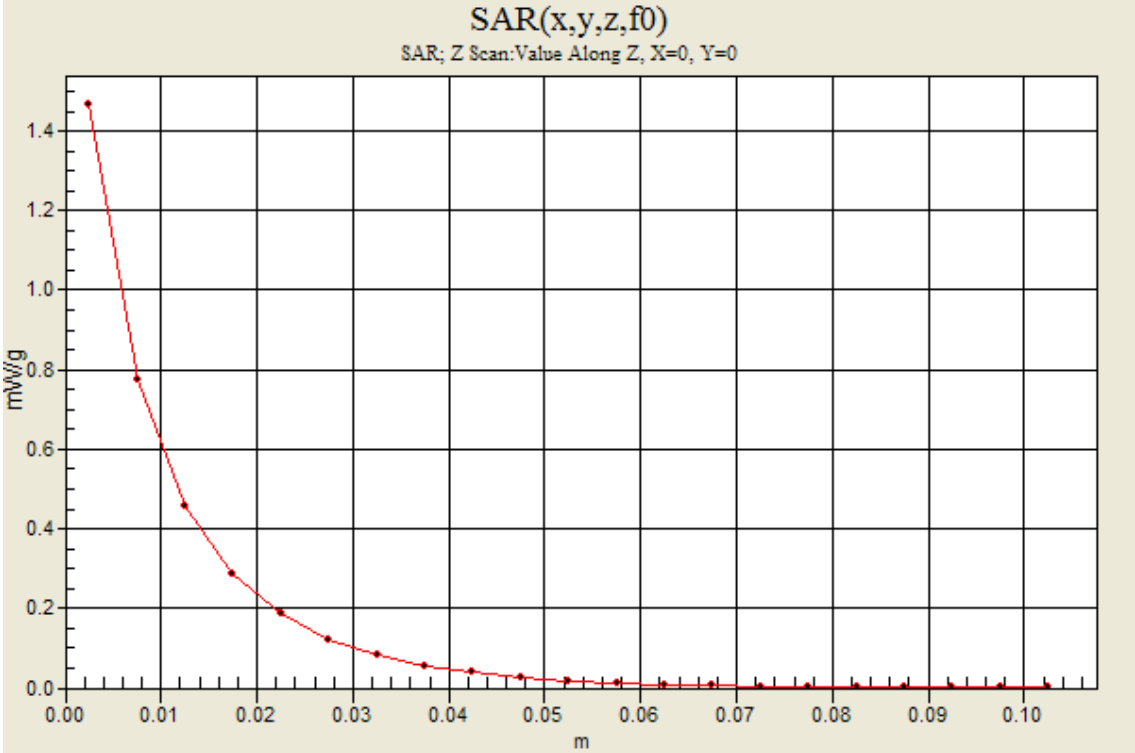
Date/Time: 10/25/2011 8:22:56 PM

Test Laboratory: UL CCS SAR Lab D

## UMTS band V

Communication System: UMTS Band V; Frequency: 836.6 MHz; Duty Cycle: 1:1

**Rear/Base_M ch/Z Scan (1x1x21):** Measurement grid: dx=20mm, dy=20mm, dz=5mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.47 mW/g



Date: 10/24/2011

Test Laboratory: UL CCS SAR Lab A

## UMTS band II

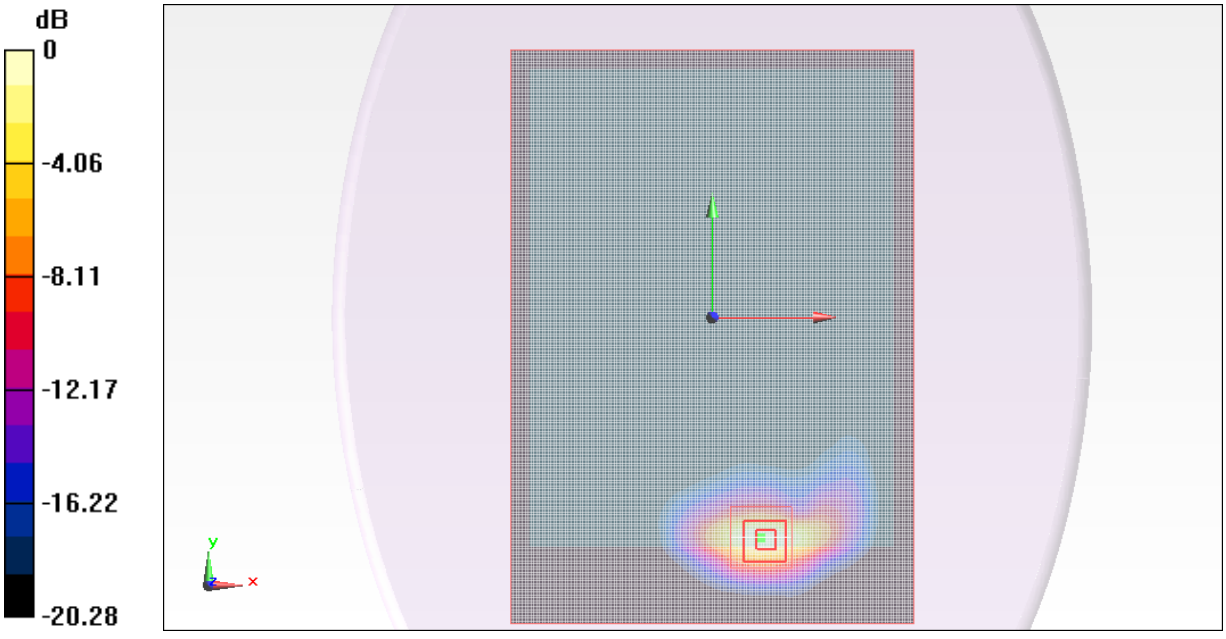
Communication System: WCDMA (UMTS); Frequency: 1880 MHz; Duty Cycle: 1:1
Medium parameters used: f = 1880 MHz; $\sigma$ = 1.453 mho/m; $\varepsilon_r$ = 51.723; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section

Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 deg. C

DASY5 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3686; ConvF(6.99, 6.99, 6.99); Calibrated: 1/24/2011
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn500; Calibrated: 7/14/2011
- Phantom: ELI v4.0(A); Type: QDOVA001BB; Serial: 1119
- Measurement SW: DASY52, Version 52.6 (2);SEMCAD X Version 14.4.5 (3634)

**Rear/Base/M ch/Area Scan (141x201x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.802 mW/g

**Rear/Base/M ch/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 34.238 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 2.236 W/kg
**SAR(1 g) = 1.18 mW/g; SAR(10 g) = 0.554 mW/g**
Maximum value of SAR (measured) = 1.662 mW/g




0 dB = 1.660mW/g

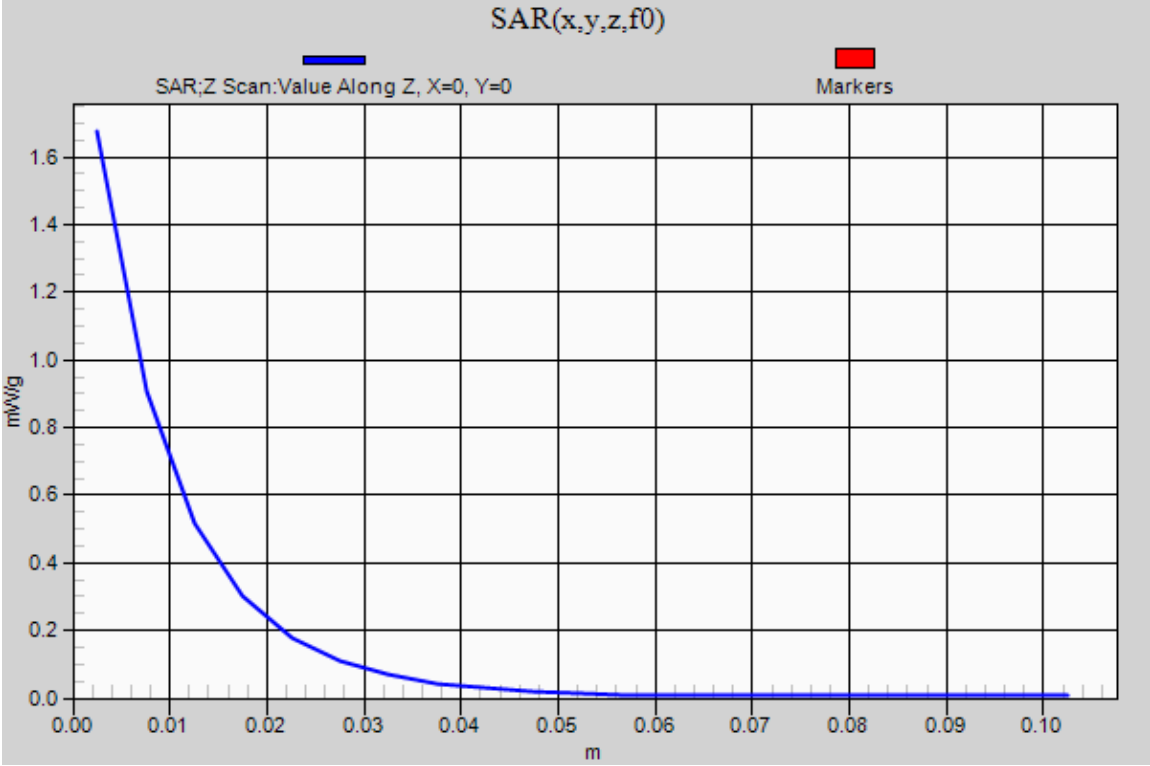
Date: 10/24/2011

Test Laboratory: UL CCS SAR Lab A

## UMTS band II

Communication System: WCDMA (UMTS); Frequency: 1880 MHz;Duty Cycle: 1:1

**Rear/Base/M ch/Z Scan (1x1x21):** Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 1.675 mW/g



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Test Laboratory: UL CCS SAR Lab D

## CDMA2000 BC0

Communication System: CDMA Cell Band; Frequency: 836.52 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 836.52 MHz; $\sigma$ = 0.968 mho/m; $\varepsilon_r$ = 55.8; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section

Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 deg. C

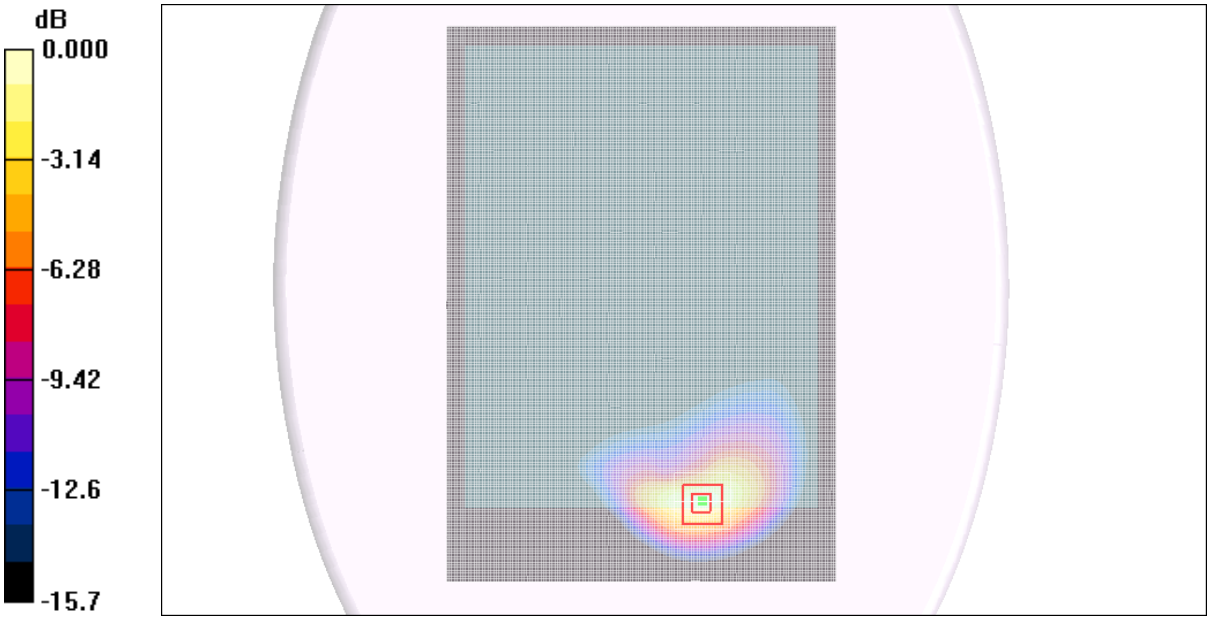
DASY4 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3749; ConvF(8.79, 8.79, 8.79); Calibrated: 12/13/2010
- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used))Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1259; Calibrated: 5/3/2011
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BB; Serial: 1017
- Measurement SW: DASY4, V4.7 Build 80; Post processing SW: SEMCAD, V1.8 Build 186

### Rear/Base_1xRTT SO32_M ch/Area Scan (141x201x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 1.50 mW/g

### Rear/Base_1xRTT SO32_M ch/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm

Reference Value = 40.6 V/m; Power Drift = 0.051 dB
Peak SAR (extrapolated) = 2.44 W/kg
**SAR(1 g) = 1.19 mW/g; SAR(10 g) = 0.629 mW/g**
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.67 mW/g




0 dB = 1.67mW/g

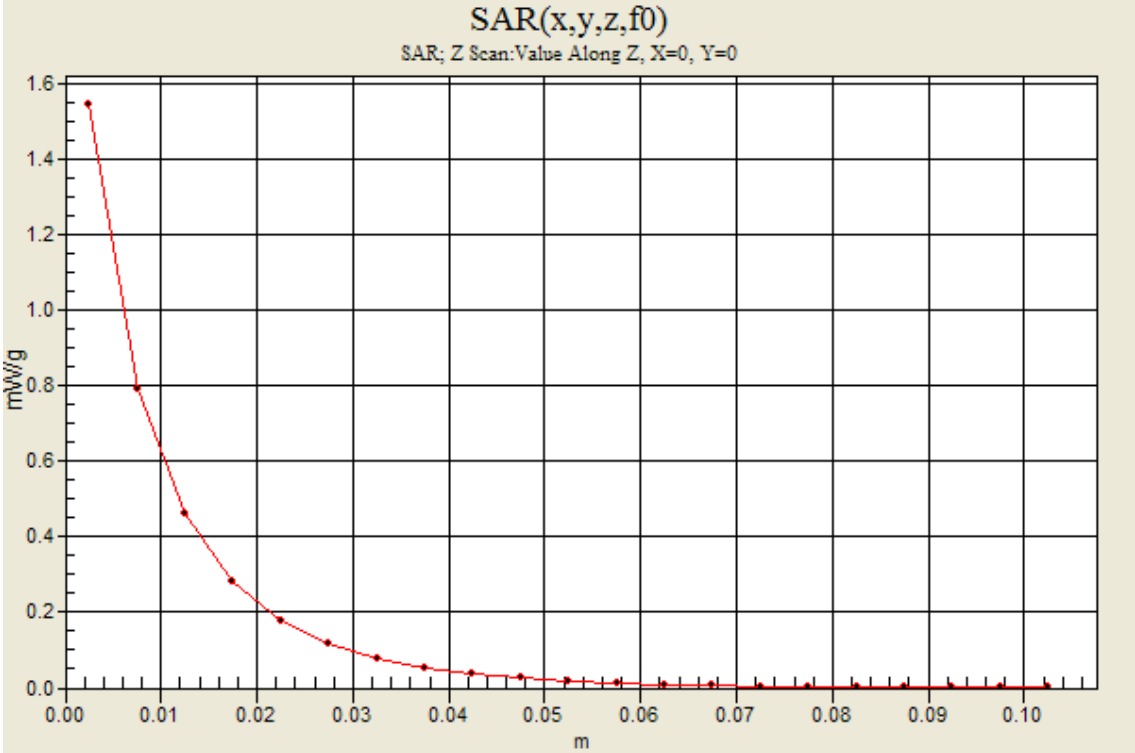
Date/Time: 10/27/2011 11:14:27 PM

Test Laboratory: UL CCS SAR Lab D

## CDMA2000 BC0

Communication System: CDMA Cell Band; Frequency: 836.52 MHz; Duty Cycle: 1:1

**Rear/Base_1xRTT SO32_M ch/Z Scan (1x1x21):** Measurement grid: dx=20mm, dy=20mm, dz=5mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.55 mW/g



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Test Laboratory: UL CCS SAR Lab D

## CDMA2000 BC0

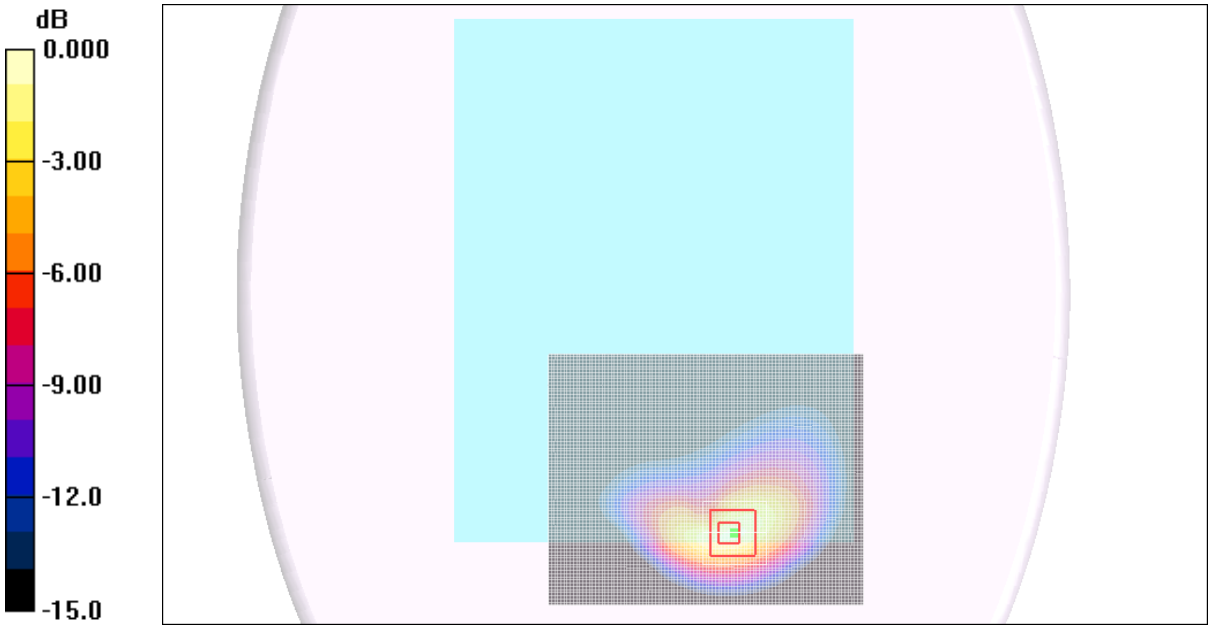
Communication System: CDMA Cell Band; Frequency: 836.52 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 836.52 MHz; $\sigma$ = 0.97 mho/m; $\varepsilon_r$ = 54.1; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section

Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 deg. C

DASY4 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3749; ConvF(8.79, 8.79, 8.79); Calibrated: 12/13/2010
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1259; Calibrated: 5/3/2011
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BB; Serial: 1017
- Measurement SW: DASY4, V4.7 Build 80; Post processing SW: SEMCAD, V1.8 Build 186

**Rear/Base_1xEV-DO_Rel.0_M ch/Area Scan (101x81x1):** Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 1.40 mW/g

**Rear/Base_1xEV-DO_Rel.0_M ch/Zoom Scan (7x7x9)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 35.6 V/m; Power Drift = 0.143 dB
Peak SAR (extrapolated) = 2.46 W/kg
**SAR(1 g) = 1.19 mW/g; SAR(10 g) = 0.623 mW/g**
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.66 mW/g




0 dB = 1.66mW/g

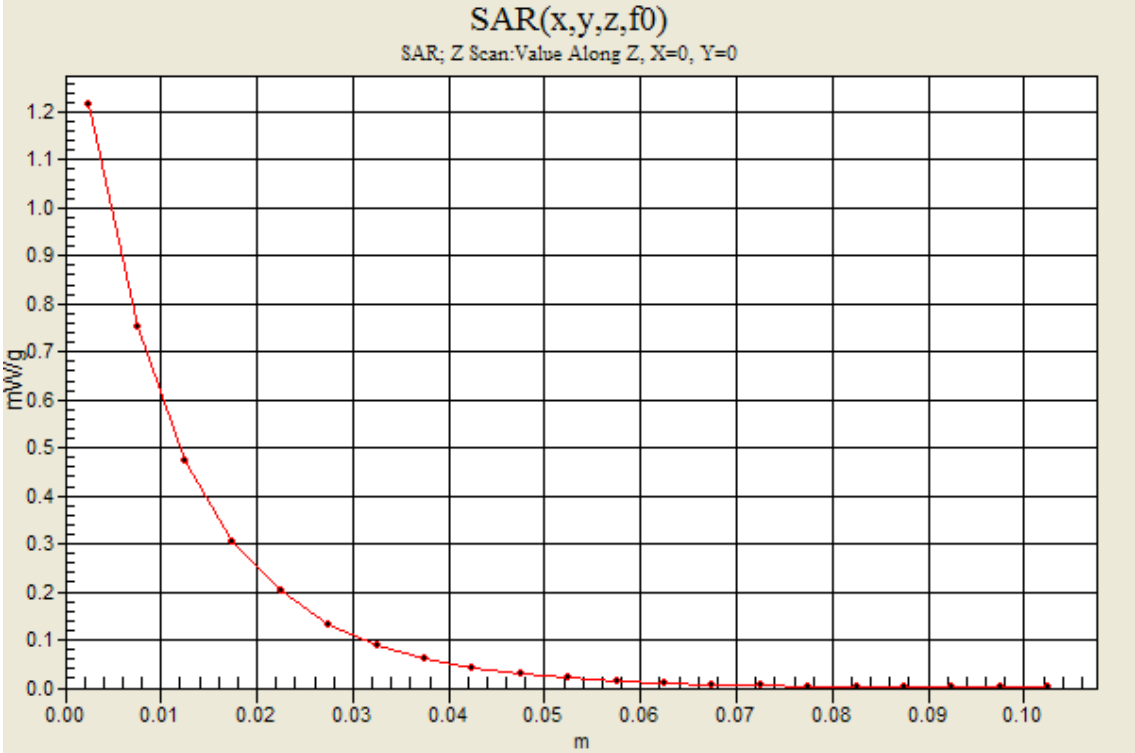
Date/Time: 10/31/2011 4:44:34 PM

Test Laboratory: UL CCS SAR Lab D

## CDMA2000 BC0

Communication System: CDMA Cell Band; Frequency: 836.52 MHz; Duty Cycle: 1:1

**Rear/Base_1xEV-DO_Rel.0_M ch/Z Scan (1x1x21):** Measurement grid: dx=20mm, dy=20mm, dz=5mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.22 mW/g



Date: 11/1/2011

Test Laboratory: UL CCS SAR Lab A

## CDMA2000 BC1_1xRTT SO32

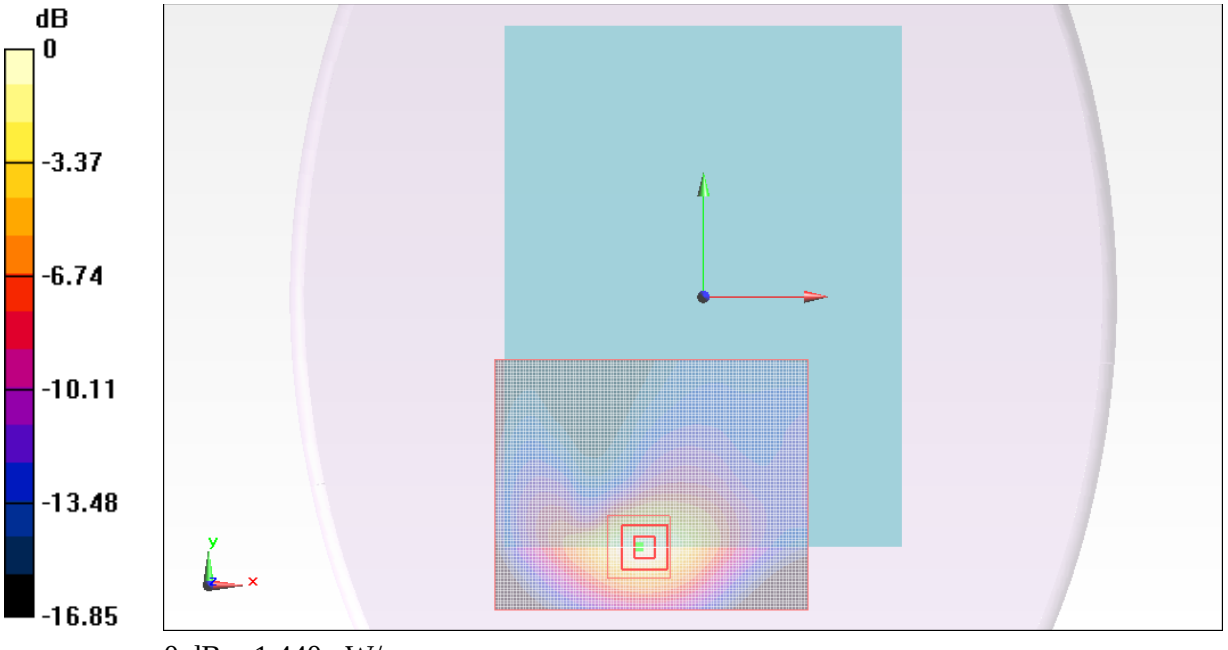
Communication System: CDMA2000 (1xRTT); Frequency: 1908.75 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 1908.75 MHz; $\sigma$ = 1.544 mho/m; $\varepsilon_r$ = 51.334; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section

Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 deg. C

DASY5 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3749; ConvF(7.33, 7.33, 7.33); Calibrated: 12/13/2010
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn500; Calibrated: 7/14/2011
- Phantom: ELI v4.0(A); Type: QDOVA001BB; Serial: 1119
- Measurement SW: DASY52, Version 52.6 (2);SEMCAD X Version 14.4.5 (3634)

**Front with 14mm/H ch/Area Scan (101x81x1):** Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 1.458 mW/g

**Front with 14mm/H ch/Zoom Scan (7x7x9)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 30.642 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 1.814 W/kg
**SAR(1 g) = 1.12 mW/g; SAR(10 g) = 0.629 mW/g**
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.438 mW/g




0 dB = 1.440mW/g

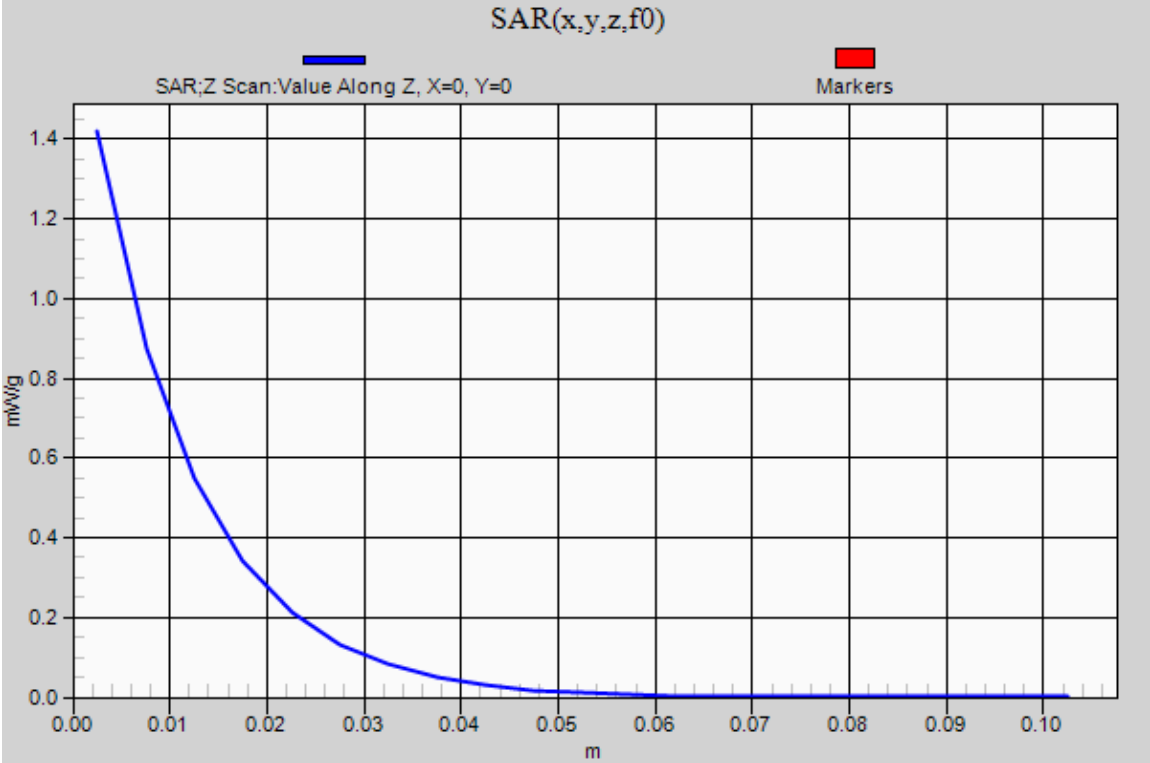
Date: 11/1/2011

Test Laboratory: UL CCS SAR Lab A

## CDMA2000 BC1_1xRTT SO32

Communication System: CDMA2000 (1xRTT); Frequency: 1908.75 MHz; Duty Cycle: 1:1

**Front with 14mm/H ch/Z Scan (1x1x21):** Measurement grid: dx=20mm, dy=20mm, dz=5mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.420 mW/g



Date: 11/2/2011

Test Laboratory: UL CCS SAR Lab A

## CDMA2000 BC1_1xEVDO Rel.0

Communication System: CDMA2000; Frequency: 1908.75 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 1908.75 MHz; $\sigma$ = 1.539 mho/m; $\varepsilon_r$ = 53.165; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section

Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 deg. C

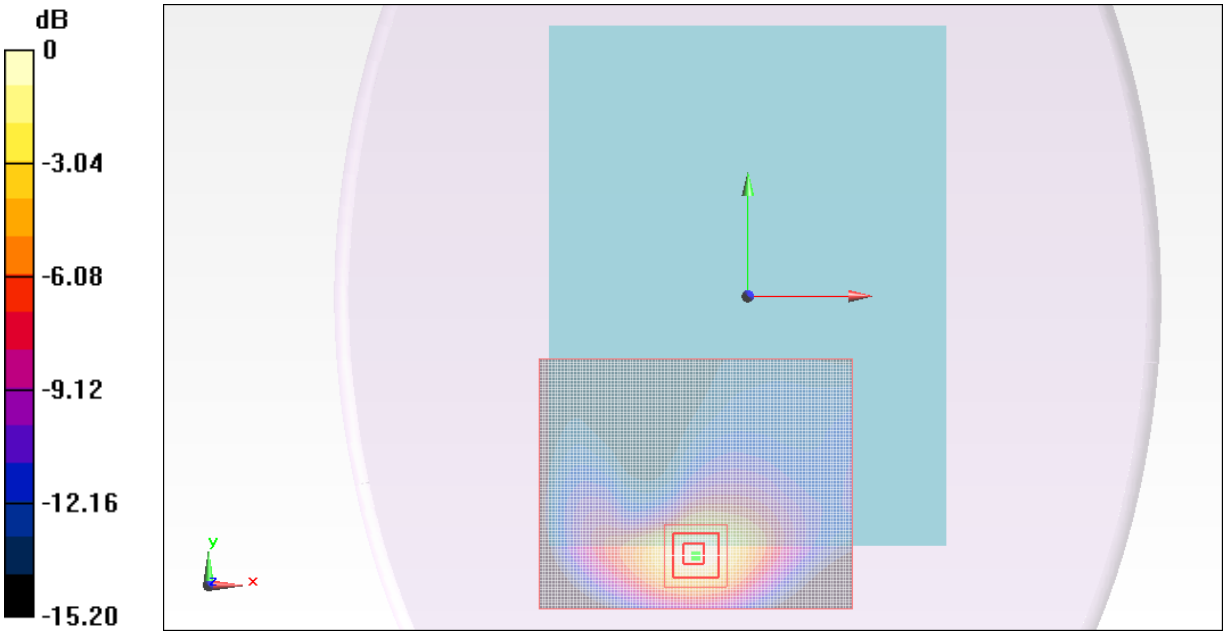
DASY5 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3749; ConvF(7.33, 7.33, 7.33); Calibrated: 12/13/2010
- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn500; Calibrated: 7/14/2011
- Phantom: ELI v4.0(A); Type: QDOVA001BB; Serial: 1119
- Measurement SW: DASY52, Version 52.6 (2);SEMCAD X Version 14.4.5 (3634)

### Front with 14mm/H ch/Area Scan (101x81x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 1.354 mW/g

### Front with 14mm/H ch/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm

Reference Value = 28.761 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 1.697 W/kg
**SAR(1 g) = 1.04 mW/g; SAR(10 g) = 0.585 mW/g**
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.336 mW/g




0 dB = 1.340mW/g

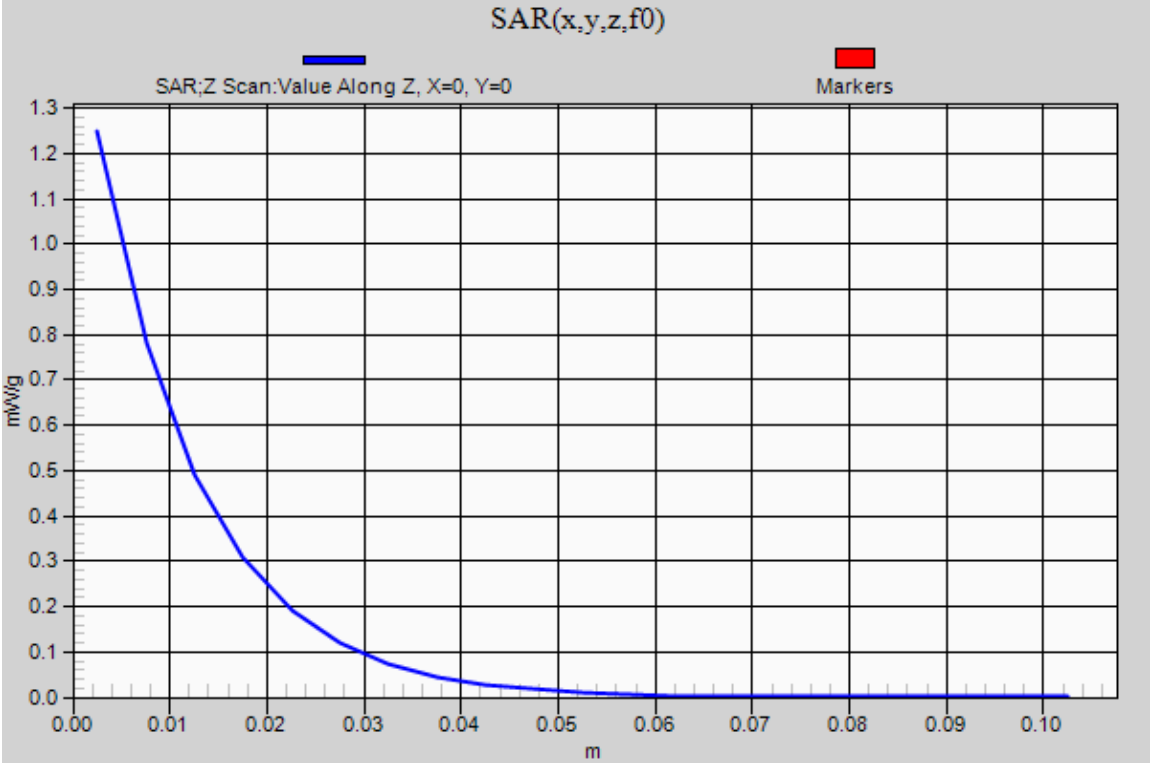
Date: 11/2/2011

Test Laboratory: UL CCS SAR Lab A

## CDMA2000 BC1_1xEVDO Rel.0

Communication System: CDMA2000; Frequency: 1908.75 MHz; Duty Cycle: 1:1

**Front with 14mm/H ch/Z Scan (1x1x21):** Measurement grid: dx=20mm, dy=20mm, dz=5mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.249 mW/g



Date/Time: 11/1/2011 1:26:53 PM

Test Laboratory: UL CCS SAR Lab D

## LTE Band 13

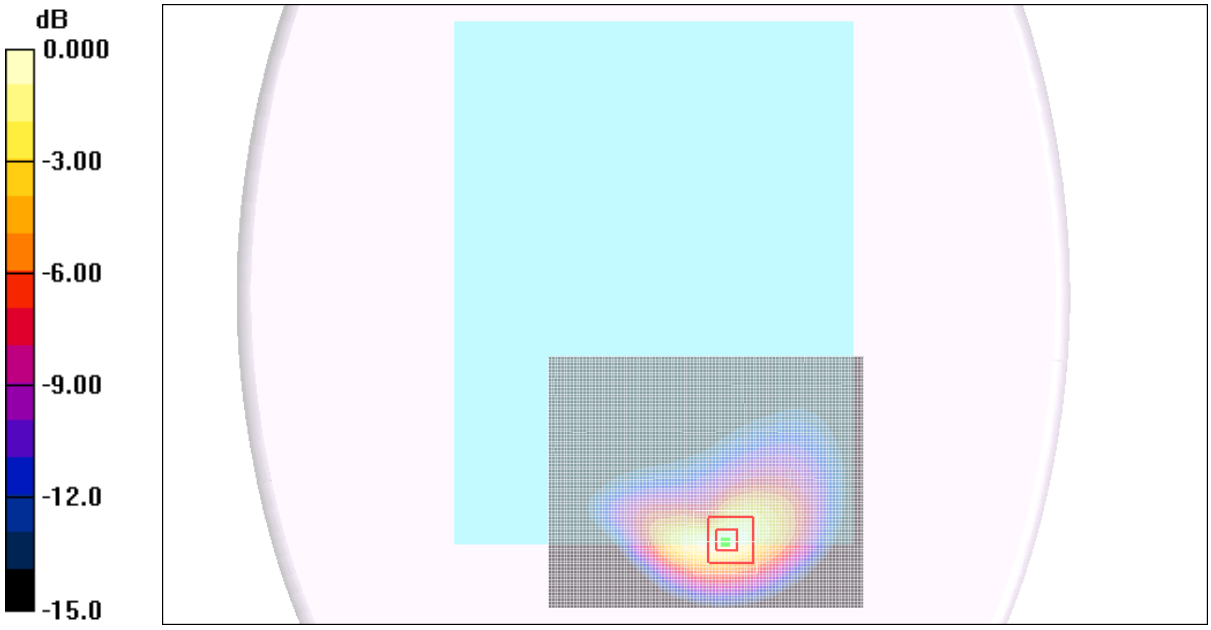
Communication System: LTE Band 13; Frequency: 782 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 782 MHz; $\sigma$ = 0.982 mho/m; $\varepsilon_r$ = 55.5; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section

Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 deg. C

DASY4 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3686; ConvF(8.87, 8.87, 8.87); Calibrated: 1/24/2011
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1259; Calibrated: 5/3/2011
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BB; Serial: 1017
- Measurement SW: DASY4, V4.7 Build 80; Post processing SW: SEMCAD, V1.8 Build 186

**Rear/Base_QPSK_RB25/12_BW 10MHz/Area Scan (101x81x1):** Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 1.46 mW/g

**Rear/Base_QPSK_RB25/12_BW 10MHz/Zoom Scan (7x7x9)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 38.1 V/m; Power Drift = -0.104 dB
Peak SAR (extrapolated) = 2.40 W/kg
**SAR(1 g) = 1.14 mW/g; SAR(10 g) = 0.595 mW/g**
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.58 mW/g




0 dB = 1.58mW/g

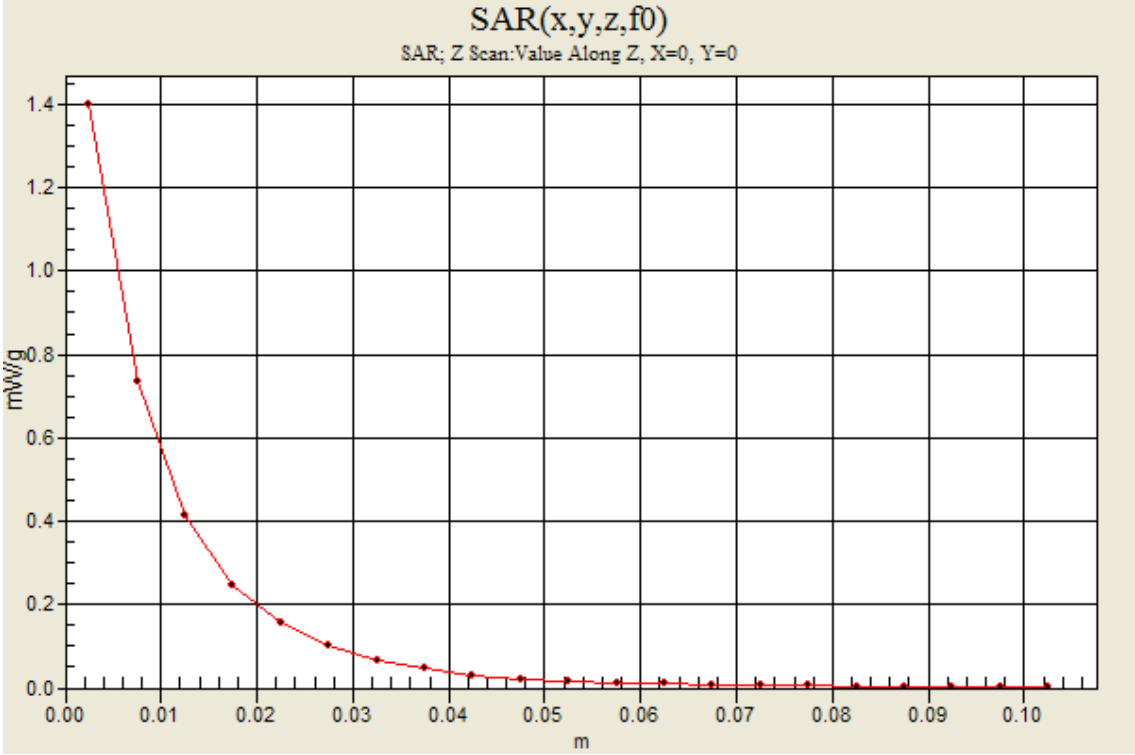
Date/Time: 11/1/2011 1:52:34 PM

Test Laboratory: UL CCS SAR Lab D

## LTE Band 13

Communication System: LTE Band 13; Frequency: 782 MHz; Duty Cycle: 1:1

**Rear/Base_QPSK_RB25/12_BW 10MHz/Z Scan (1x1x21):** Measurement grid: dx=20mm, dy=20mm, dz=5mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.40 mW/g



Date/Time: 11/1/2011 3:39:17 PM

Test Laboratory: UL CCS SAR Lab D

## LTE Band 13

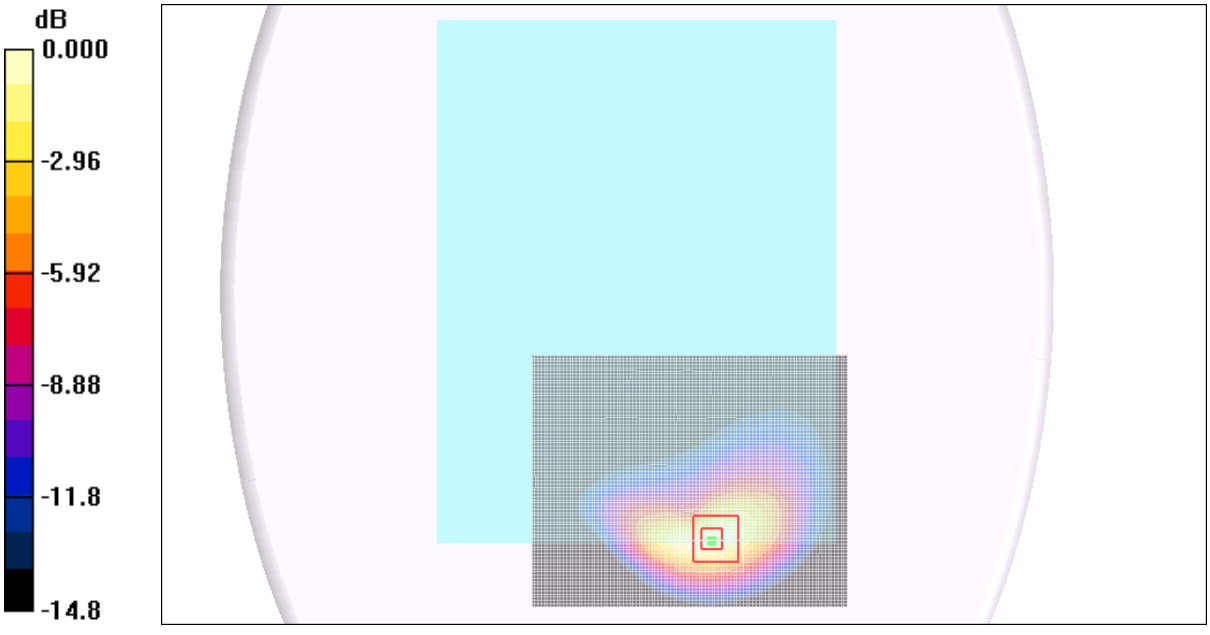
Communication System: LTE Band 13; Frequency: 782 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 782 MHz; $\sigma$ = 0.982 mho/m; $\varepsilon_r$ = 55.5; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section

Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 deg. C

DASY4 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3686; ConvF(8.87, 8.87, 8.87); Calibrated: 1/24/2011
- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used))Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1259; Calibrated: 5/3/2011
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BB; Serial: 1017
- Measurement SW: DASY4, V4.7 Build 80; Post processing SW: SEMCAD, V1.8 Build 186

**Rear/Base_16QAM_RB1/0_BW 10MHz/Area Scan (101x81x1):** Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 1.52 mW/g

**Rear/Base_16QAM_RB1/0_BW 10MHz/Zoom Scan (7x7x9)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 38.5 V/m; Power Drift = 0.036 dB
Peak SAR (extrapolated) = 2.49 W/kg
**SAR(1 g) = 1.19 mW/g; SAR(10 g) = 0.627 mW/g**
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.63 mW/g




0 dB = 1.63mW/g

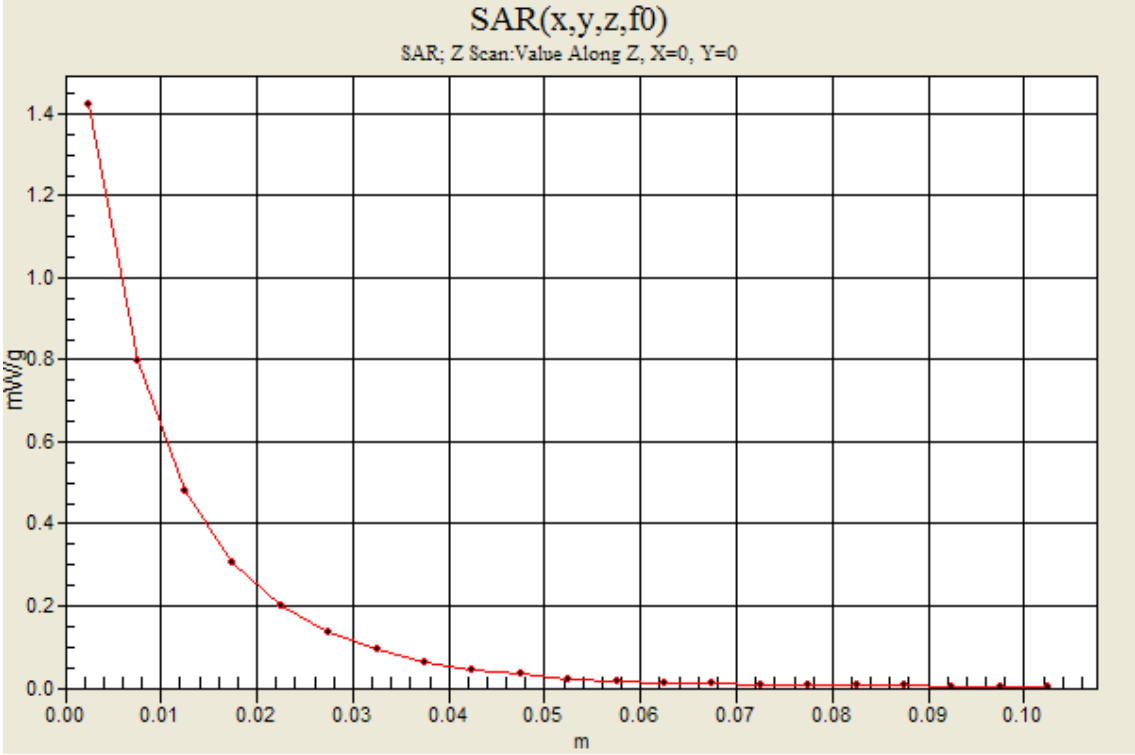
Date/Time: 11/1/2011 3:57:45 PM

Test Laboratory: UL CCS SAR Lab D

## LTE Band 13

Communication System: LTE Band 13; Frequency: 782 MHz; Duty Cycle: 1:1

**Rear/Base_16QAM_RB1/0_BW 10MHz/Z Scan (1x1x21):** Measurement grid: dx=20mm, dy=20mm, dz=5mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.42 mW/g



Date/Time: 10/11/2011 12:25:25 AM

Test Laboratory: UL CCS SAR Lab D

## WiFi 2.4GHz_Body

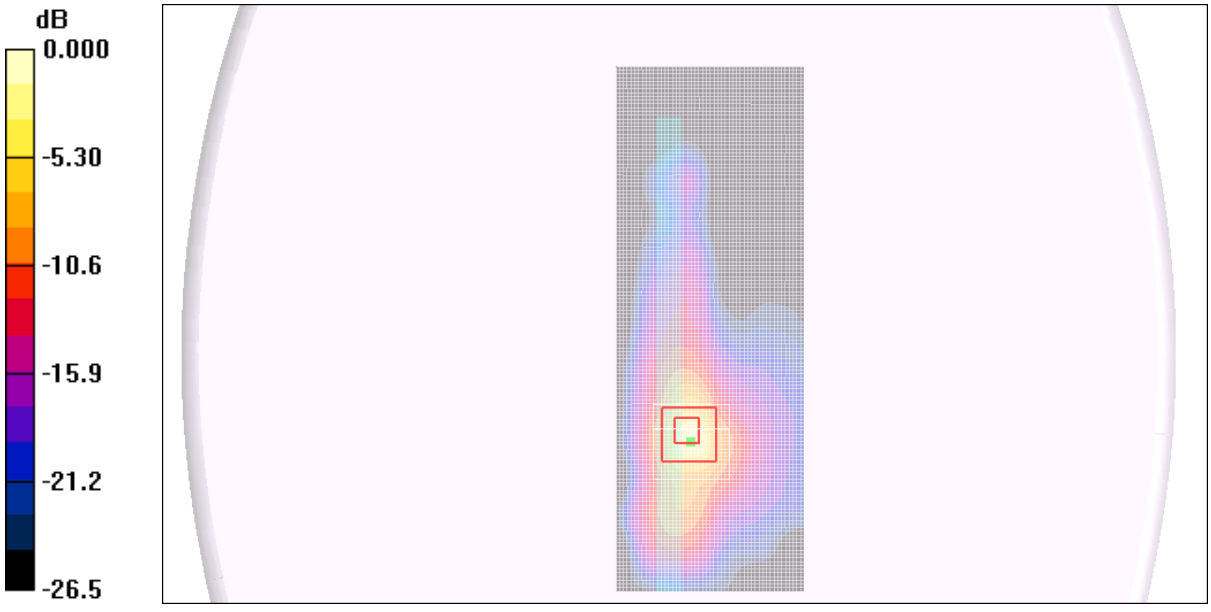
Communication System: 802.11b/g 2.4GHz; Frequency: 2462 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2462 MHz; $\sigma$ = 2 mho/m; $\varepsilon_r$ = 50.5; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section

Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 deg. C

DASY4 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3749; ConvF(6.9, 6.9, 6.9); Calibrated: 12/13/2010
- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used))Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1259; Calibrated: 5/3/2011
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BB; Serial: 1017
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

**Bottom_ch 11/Area Scan (51x141x1):** Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 1.42 mW/g

**Bottom_ch 11/Zoom Scan (7x7x9)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 29.9 V/m; Power Drift = -0.171 dB
Peak SAR (extrapolated) = 3.51 W/kg
**SAR(1 g) = 1.19 mW/g; SAR(10 g) = 0.416 mW/g**
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.93 mW/g




0 dB = 1.93mW/g

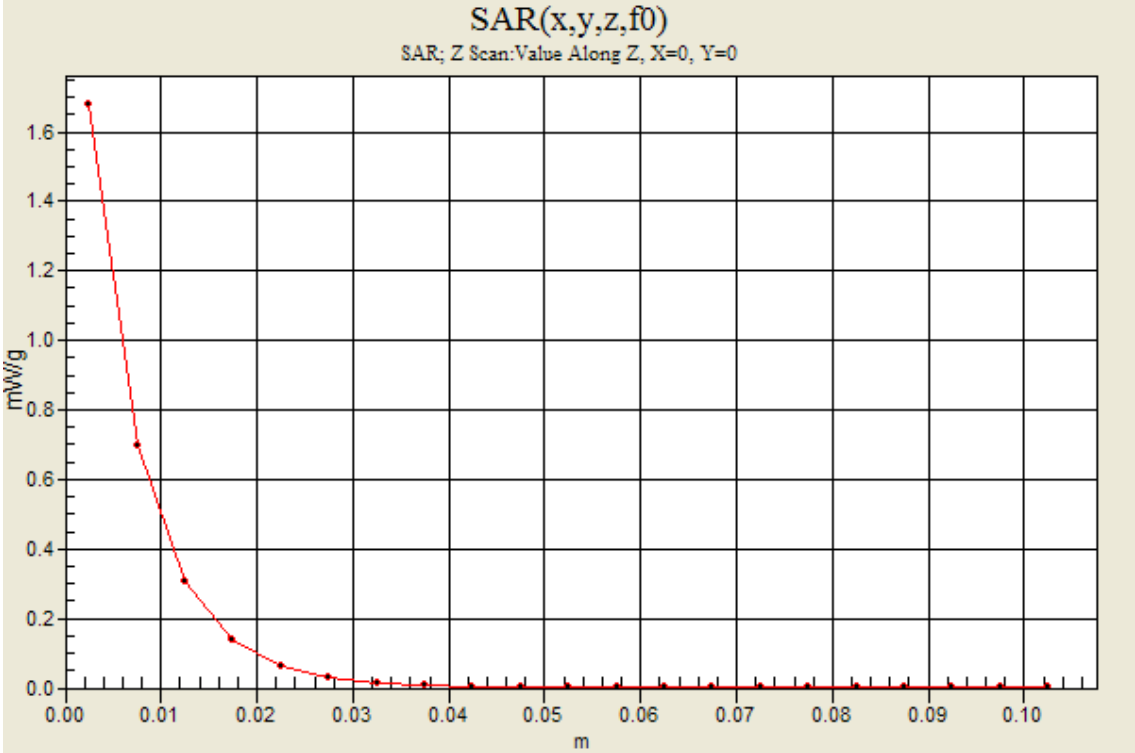
Date/Time: 10/11/2011 12:57:20 AM

Test Laboratory: UL CCS SAR Lab D

## WiFi 2.4GHz_Body

Communication System: 802.11b/g 2.4GHz; Frequency: 2462 MHz; Duty Cycle: 1:1

**Bottom_ch 11/Z Scan (1x1x21):** Measurement grid: dx=20mm, dy=20mm, dz=5mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.68 mW/g



Date/Time: 10/24/2011 6:33:11 PM

Test Laboratory: UL CCS SAR Lab D

## 5GHz_Body

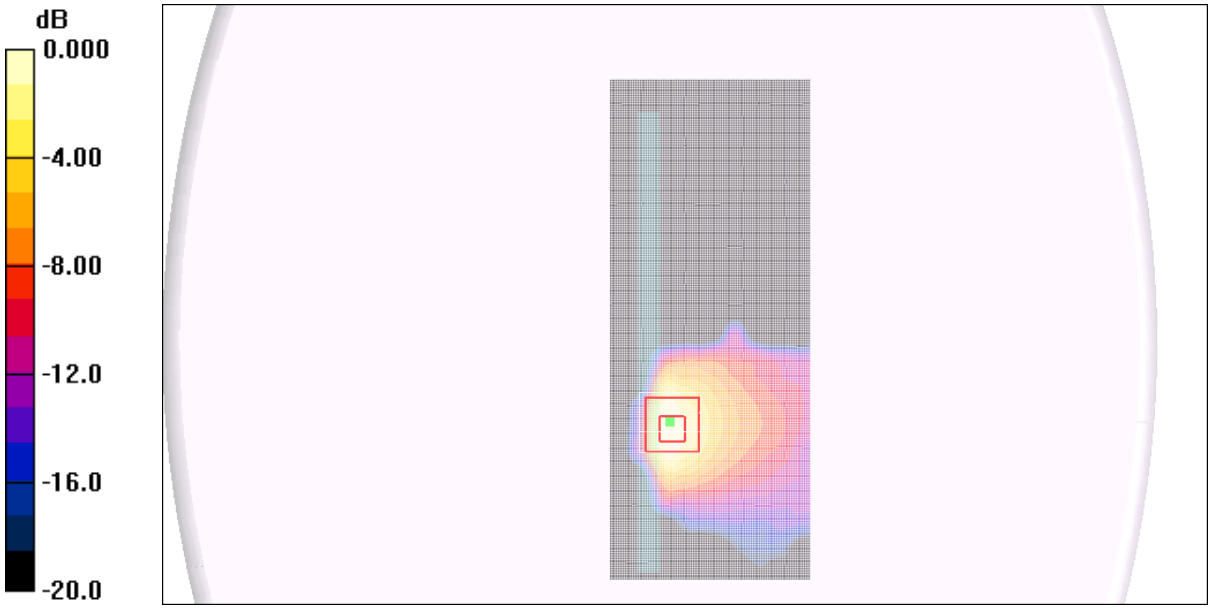
Communication System: 802.11abgn; Frequency: 5200 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5200 MHz; $\sigma$ = 5.47 mho/m; $\varepsilon_r$ = 48.6; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section

Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 deg. C

DASY4 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3749; ConvF(4.07, 4.07, 4.07); Calibrated: 12/13/2010
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1259; Calibrated: 5/3/2011
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BB; Serial: SN:1017
- Measurement SW: DASY4, V4.7 Build 80; Post processing SW: SEMCAD, V1.8 Build 186

**Bottom_Ch40/Area Scan (81x201x1):** Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.962 mW/g

**Bottom_Ch40/Zoom Scan (7x7x9)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 12.0 V/m; Power Drift = 0.176 dB
Peak SAR (extrapolated) = 1.60 W/kg
**SAR(1 g) = 0.501 mW/g; SAR(10 g) = 0.171 mW/g**
Maximum value of SAR (measured) = 0.860 mW/g




0 dB = 0.860mW/g

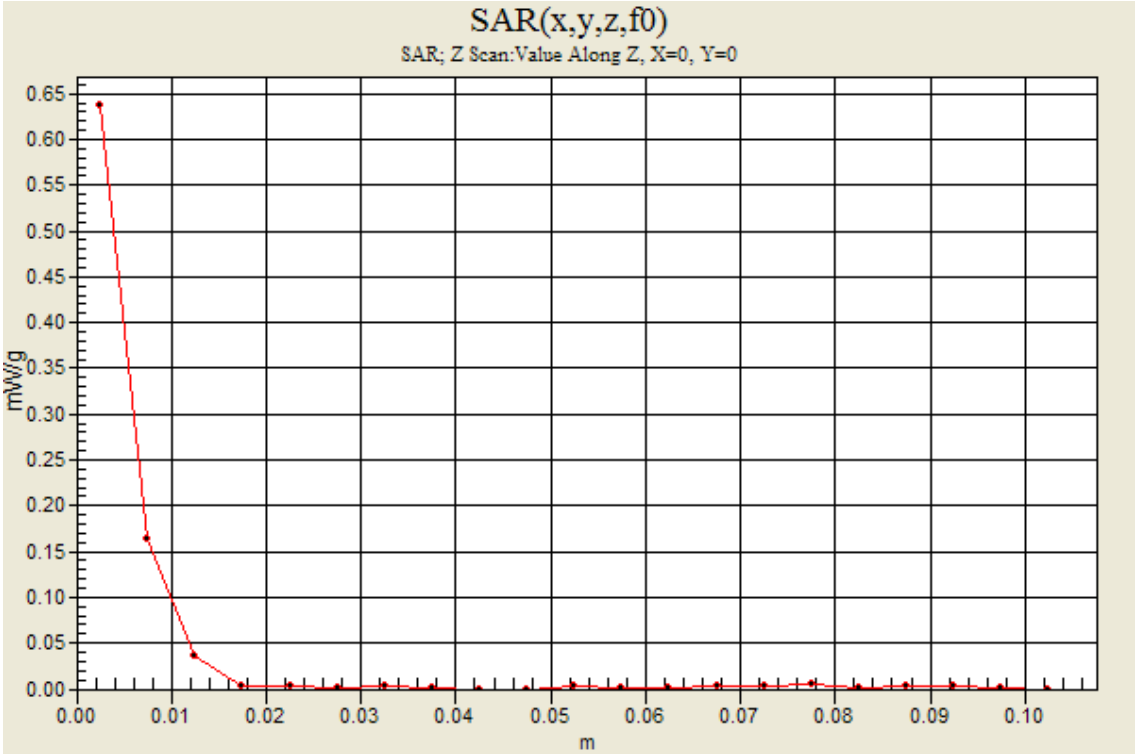
Date/Time: 10/24/2011 7:44:30 PM

Test Laboratory: UL CCS SAR Lab D

## 5GHz_Body

Communication System: 802.11abgn; Frequency: 5200 MHz; Duty Cycle: 1:1

**Bottom_Ch40/Z Scan (1x1x21):** Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 0.637 mW/g



Date: 10/12/2011

Test Laboratory: UL CCS SAR Lab A

## 5GHz_Body

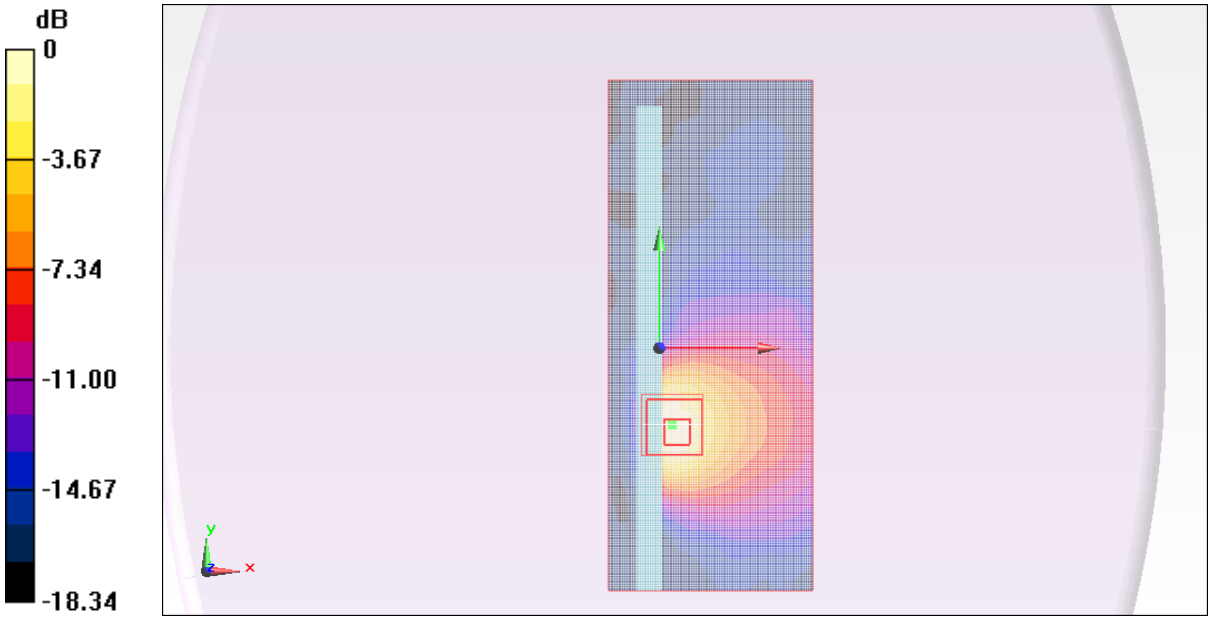
Communication System: WLAN 5GHz; Frequency: 5300 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5300 MHz; $\sigma$ = 5.587 mho/m; $\varepsilon_r$ = 49.014; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section

Room Ambient Temperature: 25.0 deg. C; Liquid Temperature: 24.0 deg. C

DASY5 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3686; ConvF(3.7, 3.7, 3.7); Calibrated: 1/24/2011
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn500; Calibrated: 7/14/2011
- Phantom: ELI v4.0(A); Type: QDOVA001BB; Serial: 1119
- Measurement SW: DASY52, Version 52.6 (2);SEMCAD X Version 14.4.5 (3634)

**Bottom/802.11a_ch 60/Area Scan (81x201x1):** Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 1.986 mW/g

**Bottom/802.11a_ch 60/Zoom Scan (7x7x9)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 18.035 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 3.601 W/kg
**SAR(1 g) = 1.12 mW/g; SAR(10 g) = 0.426 mW/g**
Maximum value of SAR (measured) = 1.804 mW/g




0 dB = 1.800mW/g

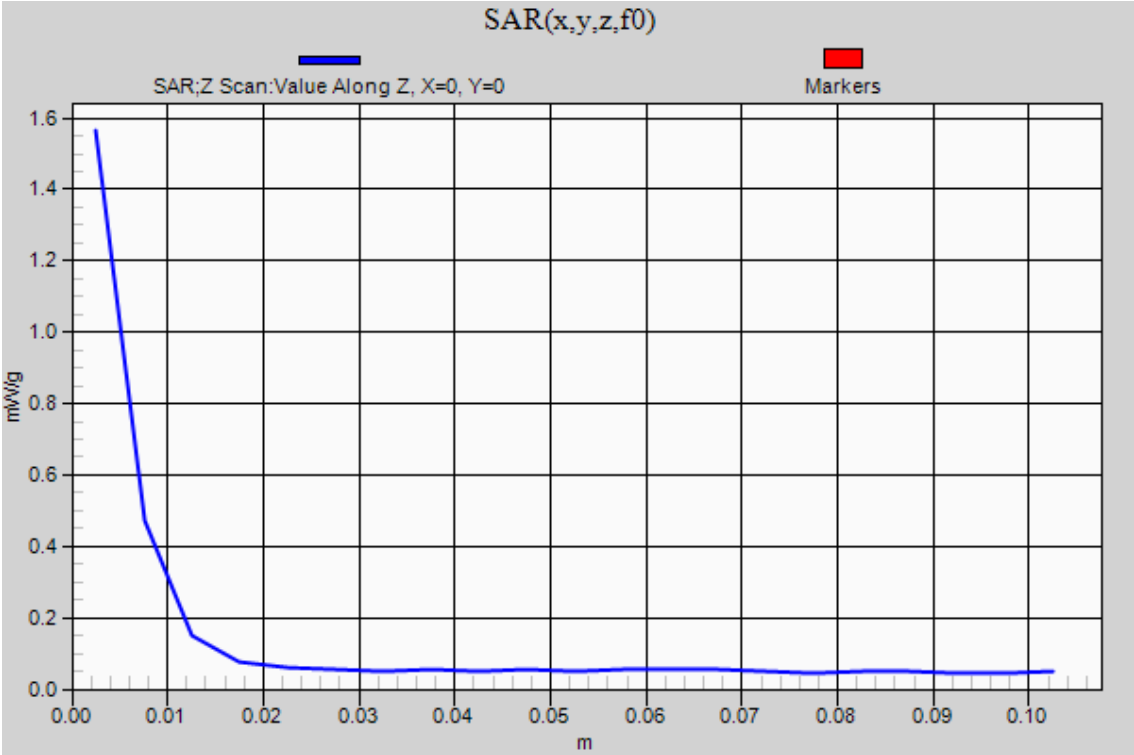
Date: 10/12/2011

Test Laboratory: UL CCS SAR Lab A

## 5GHz_Body

Communication System: WLAN 5GHz; Frequency: 5300 MHz; Duty Cycle: 1:1

**Bottom/802.11a_ch 60/Z Scan (1x1x21):** Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 1.565 mW/g



Date/Time: 10/12/2011 7:59:16 PM

Test Laboratory: UL CCS SAR Lab D

## 5GHz_Body

DUT: Apple; Type: 17 inch; Serial: N/A

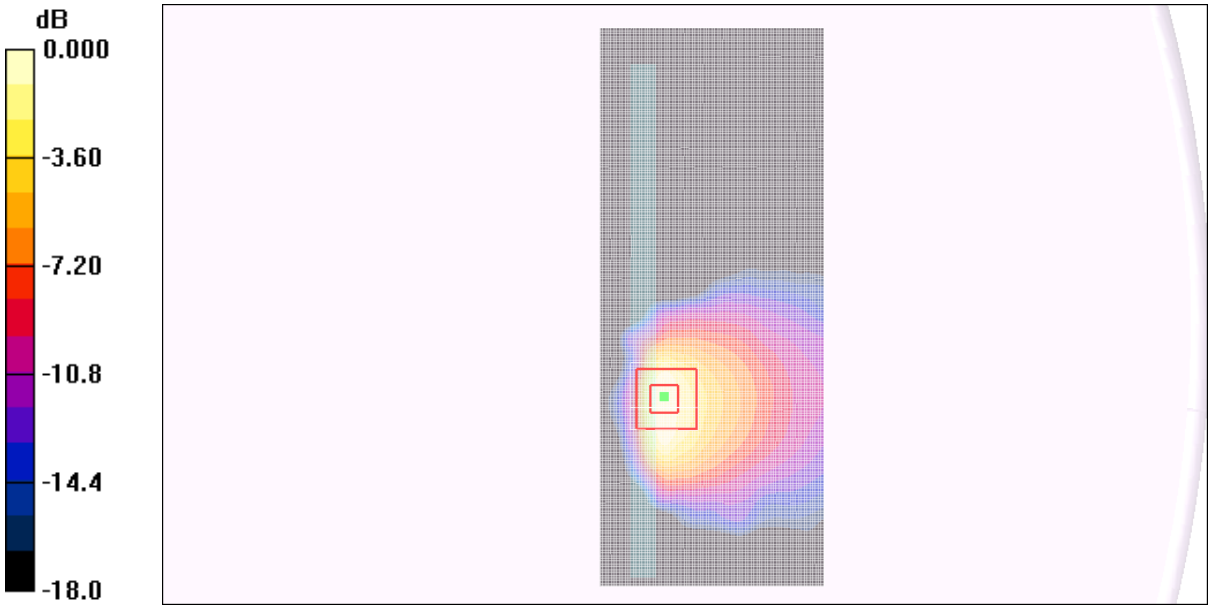
Communication System: 802.11abgn; Frequency: 5600 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5600 MHz; $\sigma$ = 5.85 mho/m; $\varepsilon_r$ = 47.6; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section

Room Ambient Temperature: 25.0 deg. C; Liquid Temperature: 24.0 deg. C

DASY4 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3749; ConvF(3.36, 3.36, 3.36); Calibrated: 12/13/2010
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1259; Calibrated: 5/3/2011
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BB; Serial: SN:1017
- Measurement SW: DASY4, V4.7 Build 80; Post processing SW: SEMCAD, V1.8 Build 186

**Bottom_Ch120/Area Scan (81x201x1):** Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 2.34 mW/g

**Bottom_Ch120/Zoom Scan (7x7x9)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 19.3 V/m; Power Drift = -0.081 dB
Peak SAR (extrapolated) = 3.45 W/kg
**SAR(1 g) = 1.08 mW/g; SAR(10 g) = 0.374 mW/g**
Maximum value of SAR (measured) = 1.83 mW/g




0 dB = 1.83mW/g

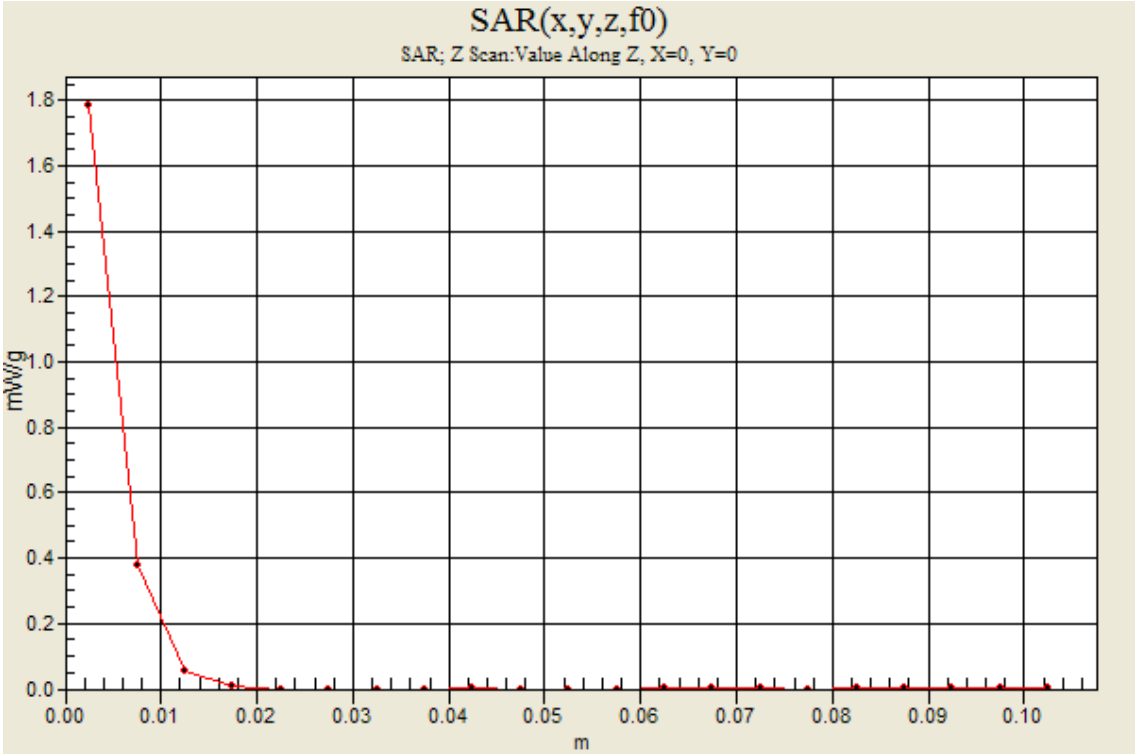
Date/Time: 10/12/2011 8:32:17 PM

Test Laboratory: UL CCS SAR Lab D

## 5GHz_Body

Communication System: 802.11abgn; Frequency: 5600 MHz; Duty Cycle: 1:1

**Bottom_Ch120/Z Scan (1x1x21):** Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 1.78 mW/g



Date/Time: 10/12/2011 1:11:13 AM

Test Laboratory: UL CCS SAR Lab D

## 5GHz_Body

DUT: Apple; Type: 17 inch; Serial: N/A

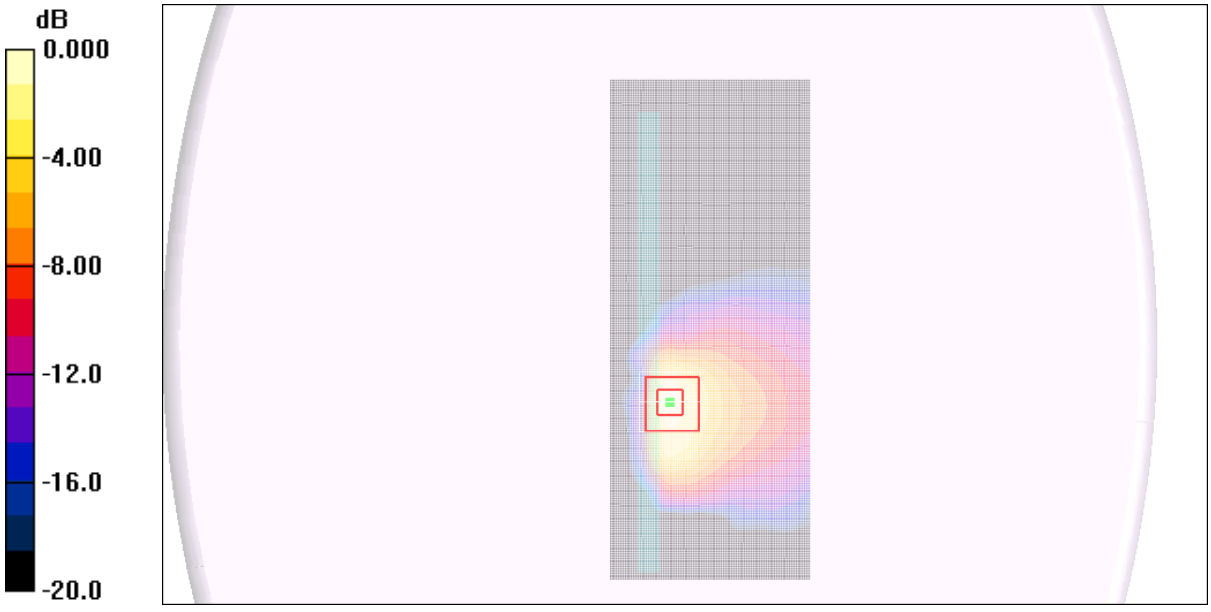
Communication System: 802.11abgn; Frequency: 5745 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5745 MHz; $\sigma$ = 6.09 mho/m; $\varepsilon_r$ = 46.2; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section

Room Ambient Temperature: 25.0 deg. C; Liquid Temperature: 24.0 deg. C

DASY4 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3749; ConvF(3.65, 3.65, 3.65); Calibrated: 12/13/2010
- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used))Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1259; Calibrated: 5/3/2011
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BB; Serial: SN:1017
- Measurement SW: DASY4, V4.7 Build 80; Post processing SW: SEMCAD, V1.8 Build 186

**Bottom_Ch149/Area Scan (81x201x1):** Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 2.09 mW/g

**Bottom_Ch149/Zoom Scan (7x7x9)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 19.2 V/m; Power Drift = -0.189 dB
Peak SAR (extrapolated) = 3.80 W/kg
**SAR(1 g) = 1.15 mW/g; SAR(10 g) = 0.401 mW/g**
Maximum value of SAR (measured) = 1.96 mW/g




0 dB = 1.96mW/g

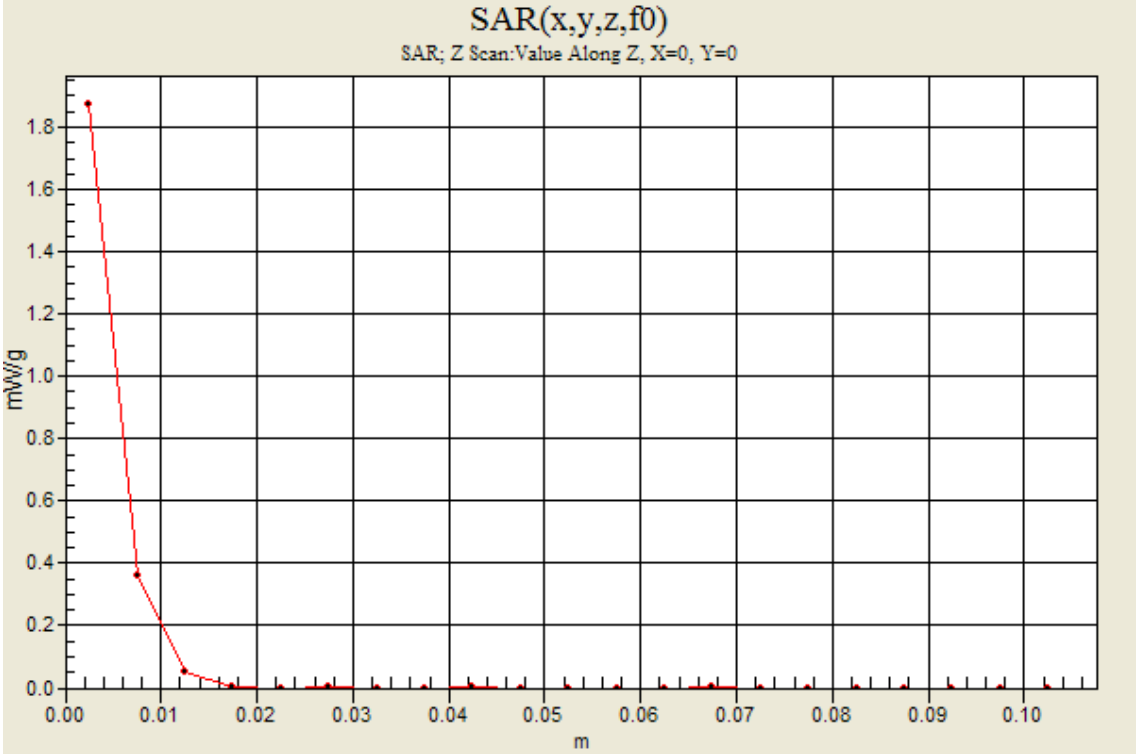
Date/Time: 10/12/2011 1:32:54 AM

Test Laboratory: UL CCS SAR Lab D

## 5GHz_Body

Communication System: 802.11abgn; Frequency: 5745 MHz; Duty Cycle: 1:1

**Bottom_Ch149/Z Scan (1x1x21):** Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 1.87 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 (3G + WiFi 2.4 GHz)

| Test Position | Data | | | | | | Data | Sum of 1g SAR (mW/g) |
|---|---|---|---|---|---|---|---|---|
| | (1) GSM 850 | (2) GSM 1900 | (3) UMTS Band V | (4) UMTS Band II | (5) CDMA BC0 | (6) CDMA BC1 | (7) WiFi 2.4G | |
| Rear | 1.17 | | | | | | 0.089 | 1.259 |
| | | 1.01 | | | | | 0.089 | 1.099 |
| | | | 1.180 | | | | 0.089 | 1.269 |
| | | | | 1.180 | | | 0.089 | 1.269 |
| | | | | | 1.190 | | 0.089 | 1.279 |
| | | | | | | 1.080 | 0.089 | 1.169 |
| Right | 0.394 | | | | | | 0.049 | 0.443 |
| | | 0.276 | | | | | 0.049 | 0.325 |
| | | | 0.316 | | | | 0.049 | 0.365 |
| | | | | 0.458 | | | 0.049 | 0.507 |
| | | | | | 0.327 | | 0.049 | 0.376 |
| | | | | | | 0.751 | 0.049 | 0.800 |
| Top | 0.627 | | | | | | 0 | 0.627 |
| | | 0.598 | | | | | 0 | 0.598 |
| | | | 0.729 | | | | 0 | 0.729 |
| | | | | 0.917 | | | 0 | 0.917 |
| | | | | | 0.772 | | 0 | 0.772 |
| | | | | | | 0.639 | 0 | 0.639 |
| Bottom | 0 | | | | | | 1.190 | 1.190 |
| | | 0 | | | | | 1.190 | 1.190 |
| | | | 0 | | | | 1.190 | 1.190 |
| | | | | 0 | | | 1.190 | 1.190 |
| | | | | | 0 | | 1.190 | 1.190 |
| | | | | | | 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 (3G + WiFi 5 GHz Bands)

| Test Position | Data | | | | | | Data | | | | Sum of 1g SAR (mW/g) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) GSM 850 | (2) GSM 1900 | (3) UMTS Band V | (4) UMTS Band II | (5) CDMA BC0 | (6) CDMA BC1 | (7) WiFi 5.2G | (8) WiFi 5.3G | (9) WiFi 5.5G | (10) WiFi 5.8G | |
| Rear | 1.17 | | | | | | 0.045 | | | | 1.215 |
| | | 1.01 | | | | | 0.045 | | | | 1.055 |
| | | | 1.180 | | | | 0.045 | | | | 1.225 |
| | | | | 1.180 | | | 0.045 | | | | 1.225 |
| | | | | | 1.190 | | 0.045 | | | | 1.235 |
| | | | | | | 1.080 | 0.045 | | | | 1.125 |
| | 1.17 | | | | | | | 0.117 | | | 1.287 |
| | | 1.01 | | | | | | 0.117 | | | 1.127 |
| | | | 1.180 | | | | | 0.117 | | | 1.297 |
| | | | | 1.180 | | | | 0.117 | | | 1.297 |
| | | | | | 1.190 | | | 0.117 | | | 1.307 |
| | | | | | | 1.080 | | 0.117 | | | 1.197 |
| | 1.17 | | | | | | | | 0.068 | | 1.238 |
| | | 1.01 | | | | | | | 0.068 | | 1.078 |
| | | | 1.180 | | | | | | 0.068 | | 1.248 |
| | | | | 1.180 | | | | | 0.068 | | 1.248 |
| | | | | | 1.190 | | | | 0.068 | | 1.258 |
| | | | | | | 1.080 | | | 0.068 | | 1.148 |
| | 1.17 | | | | | | | | | 0.069 | 1.239 |
| | | 1.01 | | | | | | | | 0.069 | 1.079 |
| | | | 1.180 | | | | | | | 0.069 | 1.249 |
| | | | | 1.180 | | | | | | 0.069 | 1.249 |
| | | | | | 1.190 | | | | | 0.069 | 1.259 |
| | | | | | | 1.080 | | | | 0.069 | 1.149 |
| Right | 0.394 | | | | | | 0.043 | | | | 0.437 |
| | | 0.276 | | | | | 0.043 | | | | 0.319 |
| | | | 0.316 | | | | 0.043 | | | | 0.359 |
| | | | | 0.458 | | | 0.043 | | | | 0.501 |
| | | | | | 0.327 | | 0.043 | | | | 0.370 |
| | | | | | | 0.751 | 0.043 | | | | 0.794 |
| | 0.394 | | | | | | | 0.052 | | | 0.446 |
| | | 0.276 | | | | | | 0.052 | | | 0.328 |
| | | | 0.316 | | | | | 0.052 | | | 0.368 |
| | | | | 0.458 | | | | 0.052 | | | 0.510 |
| | | | | | 0.327 | | | 0.052 | | | 0.379 |
| | | | | | | 0.751 | | 0.052 | | | 0.803 |
| | 0.394 | | | | | | | | 0.011 | | 0.405 |
| | | 0.276 | | | | | | | 0.011 | | 0.287 |
| | | | 0.316 | | | | | | 0.011 | | 0.327 |
| | | | | 0.458 | | | | | 0.011 | | 0.469 |
| | | | | | 0.327 | | | | 0.011 | | 0.338 |
| | | | | | | 0.751 | | | 0.011 | | 0.762 |
| | 0.394 | | | | | | | | | 0.019 | 0.413 |
| | | 0.276 | | | | | | | | 0.019 | 0.295 |
| | | | 0.316 | | | | | | | 0.019 | 0.335 |
| | | | | 0.458 | | | | | | 0.019 | 0.477 |
| | | | | | 0.327 | | | | | 0.019 | 0.346 |
| | | | | | | 0.751 | | | | 0.019 | 0.770 |

| Test Position | Data | | | | | | Data | | | | Sum of 1g SAR (mW/g) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) GSM 850 | (2) GSM 1900 | (3) UMTS Band V | (4) UMTS Band II | (5) CDMA BC0 | (6) CDMA BC1 | (7) WiFi 5.2G | (8) WiFi 5.3G | (9) WiFi 5.5G | (10) WiFi 5.8G | |
| Top | 0.627 | | | | | | 0 | | | | 0.627 |
| | | 0.598 | | | | | 0 | | | | 0.598 |
| | | | 0.729 | | | | 0 | | | | 0.729 |
| | | | | 0.917 | | | 0 | | | | 0.917 |
| | | | | | 0.772 | | 0 | | | | 0.772 |
| | | | | | | 0.639 | 0 | | | | 0.639 |
| | 0.627 | | | | | | | 0 | | | 0.627 |
| | | 0.598 | | | | | | 0 | | | 0.598 |
| | | | 0.729 | | | | | 0 | | | 0.729 |
| | | | | 0.917 | | | | 0 | | | 0.917 |
| | | | | | 0.772 | | | 0 | | | 0.772 |
| | | | | | | 0.639 | | 0 | | | 0.639 |
| | 0.627 | | | | | | | | 0 | | 0.627 |
| | | 0.598 | | | | | | | 0 | | 0.598 |
| | | | 0.729 | | | | | | 0 | | 0.729 |
| | | | | 0.917 | | | | | 0 | | 0.917 |
| | | | | | 0.772 | | | | 0 | | 0.772 |
| | | | | | | 0.639 | | | 0 | | 0.639 |
| | 0.627 | | | | | | | | | 0 | 0.627 |
| | | 0.598 | | | | | | | | 0 | 0.598 |
| | | | 0.729 | | | | | | | 0 | 0.729 |
| | | | | 0.917 | | | | | | 0 | 0.917 |
| | | | | | 0.772 | | | | | 0 | 0.772 |
| | | | | | | 0.639 | | | | 0 | 0.639 |
| Bottom | 0 | | | | | | 0.501 | | | | 0.501 |
| | | 0 | | | | | 0.501 | | | | 0.501 |
| | | | 0 | | | | 0.501 | | | | 0.501 |
| | | | | 0 | | | 0.501 | | | | 0.501 |
| | | | | | 0 | | 0.501 | | | | 0.501 |
| | | | | | | 0 | 0.501 | | | | 0.501 |
| | 0 | | | | | | | 1.120 | | | 1.120 |
| | | 0 | | | | | | 1.120 | | | 1.120 |
| | | | 0 | | | | | 1.120 | | | 1.120 |
| | | | | 0 | | | | 1.120 | | | 1.120 |
| | | | | | 0 | | | 1.120 | | | 1.120 |
| | | | | | | 0 | | 1.120 | | | 1.120 |
| | 0 | | | | | | | | 1.080 | | 1.080 |
| | | 0 | | | | | | | 1.080 | | 1.080 |
| | | | 0 | | | | | | 1.080 | | 1.080 |
| | | | | 0 | | | | | 1.080 | | 1.080 |
| | | | | | 0 | | | | 1.080 | | 1.080 |
| | | | | | | 0 | | | 1.080 | | 1.080 |
| | 0 | | | | | | | | | 1.150 | 1.150 |
| | | 0 | | | | | | | | 1.150 | 1.150 |
| | | | 0 | | | | | | | 1.150 | 1.150 |
| | | | | 0 | | | | | | 1.150 | 1.150 |
| | | | | | 0 | | | | | 1.150 | 1.150 |
| | | | | | | 0 | | | | 1.150 | 1.150 |

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

## 16.3. Body exposure condition (LTE Band 13 + WiFi 2.4 GHz)

| Test Position | Data (1) LTE Band 13 | Data (2) WiFi 2.4G | Sum of 1g SAR (mW/g) |
|---|---|---|---|
| Rear | 1.190 | 0.089 | 1.279 |
| Right | 0.473 | 0.049 | 0.522 |
| Top | 0.790 | 0.0 | 0.790 |
| 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

## 16.4. Body exposure condition (LTE Band 13 + WiFi 5 GHz Bands)

| Test Position | Data (1) LTE Band 13 | Data (2) WiFi 5.2G | (3) WiFi 5.3G | (4) WiFi 5.5G | (5) WiFi 5.8G | Sum of 1g SAR (mW/g) |
|---|---|---|---|---|---|---|
| Rear | 1.19 | 0.045 | | | | 1.235 |
| | 1.19 | | 0.117 | | | 1.307 |
| | 1.19 | | | 0.068 | | 1.258 |
| | 1.19 | | | | 0.069 | 1.259 |
| Right | 0.473 | 0.043 | | | | 0.516 |
| | 0.473 | | 0.052 | | | 0.525 |
| | 0.473 | | | 0.011 | | 0.484 |
| | 0.473 | | | | 0.019 | 0.492 |
| Top | 0.790 | 0 | | | | 0.790 |
| | 0.790 | | 0 | | | 0.790 |
| | 0.790 | | | 0 | | 0.790 |
| | 0.790 | | | | 0 | 0.790 |
| Bottom | 0 | 0.501 | | | | 0.501 |
| | 0 | | 1.120 | | | 1.120 |
| | 0 | | | 1.080 | | 1.080 |
| | 0 | | | | 1.150 | 1.150 |

**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 GSM850**

**17.3. SAR test plots for GSM1900**

**17.4. SAR test plots for UMTS Band V**

**17.5. SAR test plots for UMTS Band II**

**17.6. SAR test plots for CDMA BC0**

**17.7. SAR test plots for CDMA BC1**

**17.8. SAR test plots for LTE Band 13**

**17.9. SAR test plots for WiFi 2.4 GHz**

**17.10. SAR test plots for WiFi 5 GHz Bands**

**17.11. Calibration certificate for E-Field Probe EX3DV4 SN 3686**

**17.12. Calibration certificate for E-Field Probe EX3DV4 SN 3749**

**17.13. Calibration certificate for D750V3 SN 1019**

**17.14. Calibration Certificate for D835V2 SN 4d117**

**17.15. Calibration certificate for D1900V2 SN 5d140**

**17.16. Calibration certificate for D2450V2 SN: 706 with extended cal. Data**

**17.17. Calibration certificate for D5GHzV2 SN 1003**

# 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 |

## 18.2. Exposure conditions for WiFi

| Configuration | Antenna-to-edge/surface | SAR Required | note |
|---|---|---|---|
| Rear | 8.48 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 | 227.4 mm | No | > 20 cm |
| Bottom | 4 mm | Yes | This is the most conservative antenna-to-user distance at edge mode as per KDB 447498 4) b) ii) (2) |
| Left edge | 111.7 mm | No | This is not the most conservative antenna-to-user distance at edge mode as per KDB 447498 4) b) ii) (2) |
| Right edge | 44.6 mm | Yes | This is the most conservative antenna-to-user distance at edge mode compared with Left edge |