**OET BULLETIN 65 SUPPLEMENT C 01-01**
**IEEE Std 1528-2003 & IEEE 1528a-2005**

# SAR EVALUATION REPORT
**(Class II Permissive Change: Added W-CDMA Band IV)**

*For*
**iPhone**

**Model: A1428**
**FCC ID: BCG-E2599A**

**Report Number: 12U14759-2C**
**Issue Date: 3/27/2013**

*Prepared for*
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## Revision History

| Rev. | Issue Date | Revisions | Revised By |
|---|---|---|---|
| -- | 1/17/2013 | Initial Issue based on original UL CCS FCC SAR report "11U14136-7A1", FCC ID: BCG-E2599A. | -- |
| A | 1/25/2013 | Revised Sec. 9 based on UL CCS EMC Report "12U14759-1", FCC ID: BCG-E2599A. | Bobby Bayani |
| B | 3/25/2013 | Revised Report based on Reviewer's comments:<br>1. Sec. 14.2: Updated Simultaneous Transmission Analysis Table. | Bobby Bayani |
| C | 3/27/2013 | Revised Report based on Reviewer's comments:<br>1. Sec. 7.3: Revised Table to include WCDMA 1700MHz.<br>2. Sec. 9.1: Added Note in reference to Maximum Output Power Tune Up Limit.<br>3. Secs. 4.2, 10.2, 11.3, and 15: Removed reference to 2.4GHz. | Bobby Bayani |

## Table of Contents

# 1. Attestation of Test Results

| | |
|---|---|
| Applicant | Apple Inc. |
| DUT description | iPhone |
| Model | A1428 |
| Test device is | An identical prototype |
| Device category | Portable |
| Exposure category | General Population/Uncontrolled Exposure |
| Date tested | 12/13/2012 – 12/27/2012 |

| RF Exposure Rule | Freq. Range | Highest Reported SAR | Limit |
|---|---|---|---|
| 27 | 1710-1755 MHz | Head: 1.060 W/kg (Right Touch)<br>Body-worn accessory: 0.977 W/kg (Front w/ 10 mm distance)<br>Hotspot: 0.977 W/kg (Front w/ 10 mm distance) | 1.6 W/kg |

| Applicable Standards | Test Results |
|---|---|
| FCC Published RF exposure KDB procedures, TCB workshop updates and OET Bulletin 65 Supplement C, IEEE Std 1528-2003 and IEEE Std 1528a-2005 | Pass |

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

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

Approved & Released For UL CCS By:

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# 2. Test Methodology

The tests documented in this report were performed in accordance with FCC OET Bulletin 65 Supplement C Edition 01-01, IEEE Std 1528-2003 & IEEE 1528a-2005 and the following published KDB procedures:

- 447498 D01 General RF Exposure Guidance v05
- 648474 D04 SAR Handsets Multi Xmiter and Ant v01
- 941225 D01 SAR test for 3G devices v02
- 941225 D02 Guidance for 3GPP R6 and R7 HSPA v02v01
- 941225 D06 Hot Spot SAR v01
- 865664 D01 SAR Measurement 100 MHz to 6 GHz v01
- 865664 D02 SAR Reporting v01

# 3. Facilities and Accreditation

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

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

# 4. Calibration and Uncertainty

## 4.1. Measuring Instrument Calibration

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

| Name of Equipment | Manufacturer | Type/Model | Serial No. | Cal. Due date | | |
|---|---|---|---|---|---|---|
| | | | | MM | DD | Year |
| S-Parameter Network Analyzer | Agilent | 8753ES | MY40001647 | 6 | 27 | 2013 |
| Dielectronic Probe kit | SPEAG | SM DAK 040 CA | 1082 | 9 | 18 | 2013 |
| ENA Series Network Analyzer | Agilent | E5071B | MY42100131 | 2 | 11 | 2013 |
| Dielectronic Probe kit | HP | 85070E | 594 | N/A | | |
| Synthesized Signal Generator | HP | 8665B | 3438A00633 | 2 | 22 | 2013 |
| Power Meter | HP | 438A | 3513U04320 | 9 | 17 | 2013 |
| Power Sensor A | HP | 8481A | 2237A31744 | 8 | 17 | 2013 |
| Power Sensor B | HP | 8481A | 3318A95392 | 8 | 17 | 2013 |
| Amplifier | MITEQ | 4D00400600-50-30P | 1622052 | N/A | | |
| Directional coupler | Werlatone | C8060-102 | 2149 | N/A | | |
| Synthesized Signal Generator | HP | 8665B | 3744A01084 | 5 | 3 | 2013 |
| Power Meter | HP | 438A | 2822A05684 | 10 | 7 | 2013 |
| Power Sensor A | HP | 8481A | 2702A66876 | 8 | 1 | 2013 |
| Power Sensor B | HP | 8482A | 2349A08568 | 4 | 14 | 2013 |
| Amplifier | MITEQ | 4D00400600-50-30P | 1620606 | N/A | | |
| Directional coupler | Werlatone | C8060-102 | 2141 | N/A | | |
| Base Station Simulator | R & S | CMU200 | 106301 | 6 | 6 | 2013 |
| Base Station Simulator | Agilent | 8960 | GB42361452 | 4 | 4 | 2013 |
| Thermometer | ERTCO | 639-1S | 8350 | 7 | 30 | 2013 |
| E-Field Probe | SPEAG | EX3DV4 | 3773 | 3 | 14 | 2013 |
| Data Acquisition Electronics | SPEAG | DAE4 | 1239 | 6 | 6 | 2013 |
| System Validation Dipole | SPEAG | D1750V2 | 1053 | 8 | 15 | 2013 |
| System Validation Dipole | SPEAG | D2450V2 | 748 | 2 | 7 | 2013 |

## 4.2. Measurement Uncertainty

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

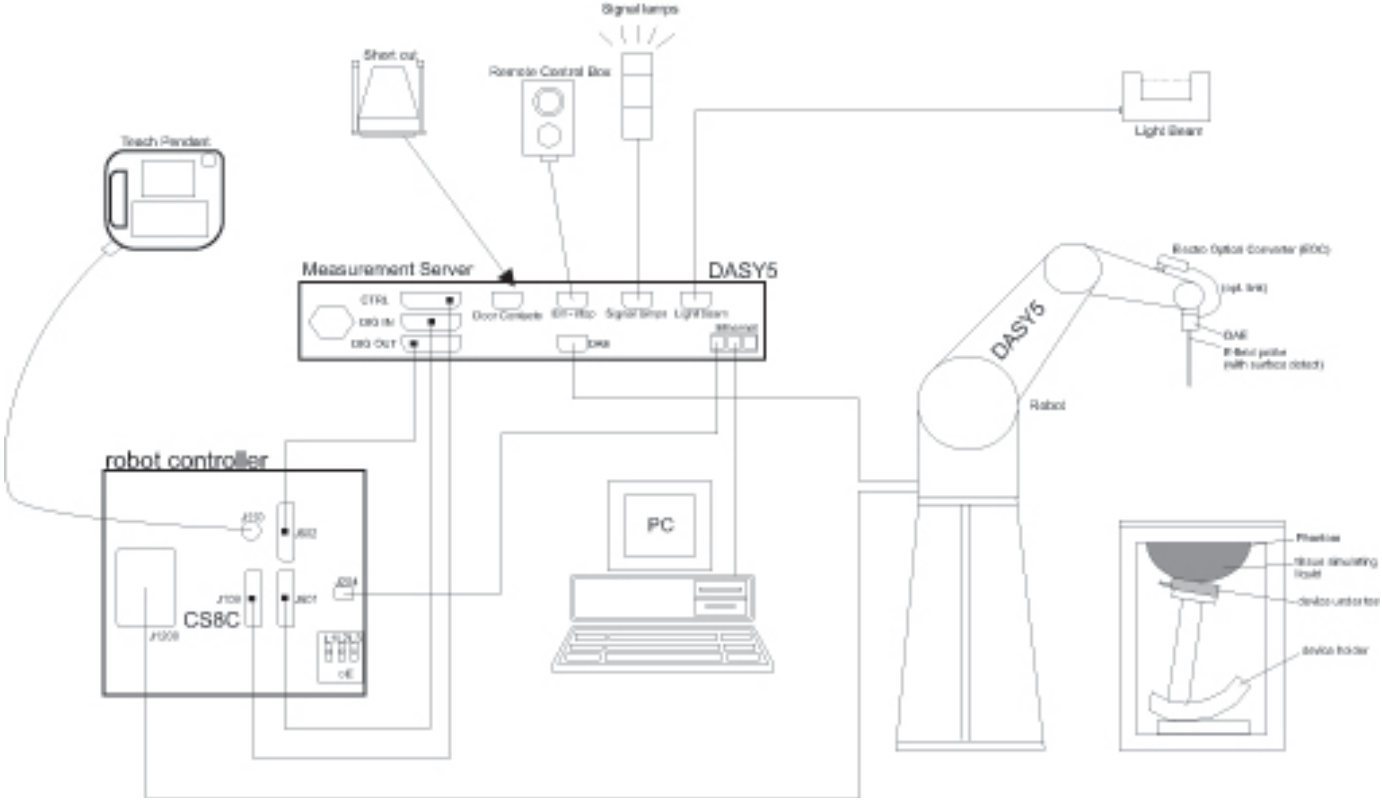
| Component | Error, % | Distribution | Divisor | Sensitivity | U (Xi), % |
|---|---|---|---|---|---|
| **Measurement System** | | | | | |
| Probe Calibration (k=1) | **6.00** | Normal | 1 | 1 | 6.00 |
| Axial Isotropy | 1.15 | Rectangular | 1.732 | 0.7071 | 0.47 |
| Hemispherical Isotropy | 2.30 | Rectangular | 1.732 | 0.7071 | 0.94 |
| Boundary Effect | 0.90 | Rectangular | 1.732 | 1 | 0.52 |
| Probe Linearity | 3.45 | Rectangular | 1.732 | 1 | 1.99 |
| System Detection Limits | 1.00 | Rectangular | 1.732 | 1 | 0.58 |
| Readout Electronics | 0.30 | Normal | 1 | 1 | 0.30 |
| Response Time | 0.80 | Rectangular | 1.732 | 1 | 0.46 |
| Integration Time | 2.60 | Rectangular | 1.732 | 1 | 1.50 |
| RF Ambient Conditions - Noise | 3.00 | Rectangular | 1.732 | 1 | 1.73 |
| RF Ambient Conditions - Reflections | 3.00 | Rectangular | 1.732 | 1 | 1.73 |
| Probe Positioner Mechanical Tolerance | 0.40 | Rectangular | 1.732 | 1 | 0.23 |
| Probe Positioning with respect to Phantom | 2.90 | Rectangular | 1.732 | 1 | 1.67 |
| Extrapolation, Interpolation and Integration | 1.00 | Rectangular | 1.732 | 1 | 0.58 |
| **Test Sample Related** | | | | | |
| Test Sample Positioning | 2.90 | Normal | 1 | 1 | 2.90 |
| Device Holder Uncertainty | 3.60 | Normal | 1 | 1 | 3.60 |
| Output Power Variation - SAR Drift | 5.00 | Rectangular | 1.732 | 1 | 2.89 |
| **Phantom and Tissue Parameters** | | | | | |
| Phantom Uncertainty (shape and thickness) | 4.00 | Rectangular | 1.732 | 1 | 2.31 |
| Liquid Conductivity - deviation from target | 5.00 | Rectangular | 1.732 | 0.64 | 1.85 |
| Liquid Conductivity - measurement | **-4.59** | Normal | 1 | 0.64 | -2.94 |
| Liquid Permittivity - deviation from target | 5.00 | Rectangular | 1.732 | 0.6 | 1.73 |
| Liquid Permittivity - measurement uncertainty | **-3.57** | Normal | 1 | 0.6 | -2.14 |
| | | | | Combined Standard Uncertainty Uc(y) = | 10.40 |
| | | | | Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence = | 20.79 % |
| | | | | Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence = | 1.64 dB |

Measurement uncertainty for 30 MHz to 6 GHz averaged over 1 gram (Body)

| Component | Error, ±% | Prob Dist | Divisor | Sensitivity | U (Xi), % |
|---|---|---|---|---|---|
| **Measurement System** | | | | | |
| Probe Calibration (k=1) | **6.00** | Normal | 1 | 1 | 6.00 |
| Axial Isotropy | 1.15 | Rectangular | 1.732 | 0.7071 | 0.47 |
| Hemispherical Isotropy | 2.30 | Rectangular | 1.732 | 0.7071 | 0.94 |
| Boundary Effect | 0.90 | Rectangular | 1.732 | 1 | 0.52 |
| Probe Linearity | 3.45 | Rectangular | 1.732 | 1 | 1.99 |
| Modulation Response | 2.40 | Rectangular | 1.732 | 1 | 1.39 |
| 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 Noise | 3.00 | Rectangular | 1.732 | 1 | 1.73 |
| RF Ambient Reflections | 3.00 | Rectangular | 1.732 | 1 | 1.73 |
| Probe Positioner | 0.80 | Rectangular | 1.732 | 1 | 0.46 |
| Probe Positioning | 6.70 | Rectangular | 1.732 | 1 | 3.87 |
| Post-processing | 4.00 | Rectangular | 1.732 | 1 | 2.31 |
| **Test Sample Related** | | | | | |
| Device Holder | 3.60 | Normal | 1 | 1 | 3.60 |
| Test Sample Positioning | 3.00 | Normal | 1 | 1 | 3.00 |
| Power Scaling | 1.00 | Rectangular | 1.732 | 1 | 0.58 |
| Power Drift | 5.00 | Rectangular | 1.732 | 1 | 2.89 |
| **Phantom and Setup** | | | | | |
| Phantom Uncertainty | 7.90 | Rectangular | 1.732 | 1 | 4.56 |
| SAR Correction | 1.90 | Rectangular | 1.732 | 1 | 1.10 |
| Liquid Conductivity - measurement | **-3.38** | Rectangular | 1.732 | 0.78 | -1.52 |
| Liquid Permittivity - measurement | **-2.21** | Rectangular | 1.732 | 0.26 | -0.33 |
| Liquid Conductivity - temperature uncertainty | 5.22 | Rectangular | 1.732 | 0.78 | 2.35 |
| Liquid Permittivity - temperature uncertainty | 0.84 | Rectangular | 1.732 | 0.23 | 0.11 |
| | | | | Combined Standard Uncertainty Uc(y) = | 11.49 |
| | | | | Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence = | 22.98 % |
| | | | | Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence = | 1.80 dB |

# 5. Measurement System Description and Setup

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




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

# 6. SAR Measurement Procedure

## 6.1. Normal SAR Measurement Procedure

**Step 1: Power Reference Measurement**
The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. The minimum distance of probe sensors to surface is 2.1 mm. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

**Step 2: Area Scan**
The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE Standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan). If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly.

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

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

**Step 3: Zoom Scan**

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

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

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

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

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

**Step 4: Power drift measurement**

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

**Step 5: Z-Scan (FCC only)**

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

## 6.2. Volume Scan Procedures

**Step 1: Repeat Step 1-4 in Section 6.1**

**Step 2: Volume Scan**
Volume Scans are used to assess peak SAR and averaged SAR measurements in largely extended 3-dimensional volumes within any phantom. This measurement does not need any previous area scan. The grid can be anchored to a user specific point or to the current probe location.

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

# 7. Device Under Test

| iPhone<br>Model: A1428 | |
|---|---|
| Normal operation | • Held to head,<br>• Body-worn (Rear and Front sides) with 10 mm separation distance.<br>• Hotspot (wireless router) with 10 mm separation distance to all sides and edges. |
| Accessory | 1. Headset |

## 7.1. Band and Air Interfaces

| Tx Frequencies | **Model: A1428** |
|---|---|
| | • GSM850: 824 - 849 MHz<br>• GSM1900: 1850 - 1910 MHz<br>• W-CDMA Band II: 1850 - 1910 MHz<br>• W-CDMA Band IV: 1710 - 1755 MHz<br>• W-CDMA Band V: 824 - 849 MHz<br>• LTE Band 2: 1850 - 1910 MHz<br>• LTE Band 4: 1710 - 1755 MHz<br>• LTE Band 5: 824 - 849 MHz<br>• LTE Band 17: 704 - 716 MHz<br>• 802.11a/b/g/n: 2412 - 2462 MHz<br>5180 – 5825 MHz<br>• Bluetooth: 2402 - 2480 MHz |
| Mode | • GSM/GPRS/EGPRS<br>• UMTS Rel 99<br>• HSDPA (Rel 7, CAT 14)<br>• HSUPA (Rel 6, CAT 6)<br>• DC-HSDPA (Rel 8, CAT 24)<br>• HSPA+ (Rel 6, CAT 6)<br>• 802.11a/b/g/n HT20<br>• Bluetooth 4.0 LE |
| GPRS Multi-Slot Class | 10 |
| GPRS Class | B |
| DTM Class | Not supported |

## 7.2. Hotspot (Wireless router) Exposure Condition

The device is capable of personal hotspot mode with WiFi in the 2.4 GHz band. The hotspot mode can be enabled by the user. However, the 5 GHz bands do not support hotspot mode.

## 7.3. Simultaneous Transmission

WWAN Radio (GSM/GPRS/EGPRS/UMTS/LTE) can transmit simultaneously with WiFi/BT Radio.
- WiFi 2.4 GHz Radio cannot transmit simultaneously with Bluetooth Radio.
- WiFi 5 GHz Radio can transmit simultaneously with Bluetooth Radio

- TX1 = LAT/Primary Antenna
- TX2 = UAT/Secondary Antenna
- TX3 = WiFi/Bluetooth Antenna. WiFi 2.4 GHz and 5 GHz share the same antenna with each other and Bluetooth
- WWAN transmits using either TX1 or TX2 and not TX3, and TX1 and TX2 never transmit simultaneously. At any given time only one technology (GSM/UMTS/LTE) can transmit from Tx1 or Tx2.
- WiFi and BT transmit using only TX3

### 7.3.1. Head Exposure Conditions

A1428 Cellular + Wifi

| User usage | SAR Test distance | Mode | Mode of Operation | Band | LTE data | GSM Voice | WCDMA Voice | GPRS/ EGPRS | DC-HSDPA | HSDPA / HSPA+ (HSDPA/HSUPA) | Wi-Fi 5GHz | Wi-Fi 2.4GHz | BT 2.4GHz |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Head | 0 cm | Voice | GSM Voice | 850 | No | Tx1/2 | No | No | No | No | No | Tx3 | No |
| | | | GSM Voice | 1900 | No | Tx1/2 | No | No | No | No | No | | No |
| | | | WCDMA Voice | 835 | No | No | Tx1/2 | No | No | No | No | | No |
| | | | WCDMA Voice | 1700 | No | No | Tx1/2 | No | No | No | No | | No |
| | | | WCDMA Voice | 1900 | No | No | Tx1/2 | No | No | No | No | | No |
| | | | LTE VOIP* | 710 | Tx1/2 | No | No | No | No | No | No | | No |
| | | | LTE VOIP* | 850 | Tx1/2 | No | No | No | No | No | No | | No |
| | | | LTE VOIP* | 1700 | Tx1/2 | No | No | No | No | No | No | | No |
| | | | LTE VOIP* | 1900 | Tx1/2 | No | No | No | No | No | No | | No |
| | | | GSM Voice | 850 | No | Tx1/2 | No | No | No | No | Tx3 | No | No |
| | | | GSM Voice | 1900 | No | Tx1/2 | No | No | No | No | | No | No |
| | | | WCDMA Voice | 835 | No | No | Tx1/2 | No | No | No | | No | No |
| | | | WCDMA Voice | 1700 | No | No | Tx1/2 | No | No | No | | No | No |
| | | | WCDMA Voice | 1900 | No | No | Tx1/2 | No | No | No | | No | No |
| | | | LTE VOIP | 710 | Tx1/2 | No | No | No | No | No | No | No | No |
| | | | LTE VOIP | 850 | Tx1/2 | No | No | No | No | No | | No | No |
| | | | LTE VOIP | 1700 | Tx1/2 | No | No | No | No | No | | No | No |
| | | | LTE VOIP | 1900 | Tx1/2 | No | No | No | No | No | | No | No |

## 7.3.2. Body-worn Accessory Exposure Condition

A1428 Cellular + Wi-Fi, Cellular+ BT Simultaneous Transmission Configurations

| User usage | SAR Test distance | Mode | Mode of Operation | Band | LTE | GSM Voice | WCDMA Voice | GPRS/ EGPRS | WCDMA | DC-HSDPA/HSPA+ (HSDPA/HSUPA) | Wi-Fi 5GHz | Wi-Fi 2.4GHz | BT 2.4GHz |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Body-worn accessory | 1 cm | Cellular + 2.4GHz Wifi | GSM Voice | 850 | No | Tx1/2 | No | No | No | No | No | Tx3 | No |
| | | | GSM Voice | 1900 | No | Tx1/2 | No | No | No | No | No | | No |
| | | | WCDMA Voice | 835 | No | No | Tx1/2 | No | No | No | No | | No |
| | | | WCDMA Voice | 1700 | No | No | Tx1/2 | No | No | No | No | | No |
| | | | WCDMA Voice | 1900 | No | No | Tx1/2 | No | No | No | No | | No |
| | | | GPRS/ EGPRS | 850 | No | No | No | Tx1/2 | No | No | No | No | No |
| | | | GPRS/ EGPRS | 1900 | No | No | No | Tx1/2 | No | No | No | No | No |
| | | | DC-HSDPA | 835 | No | No | No | No | Tx1/2 | No | No | No | No |
| | | | DC-HSDPA | 1700 | No | No | No | No | Tx1/2 | No | No | No | No |
| | | | DC-HSDPA | 1900 | No | No | No | No | Tx1/2 | No | No | No | No |
| | | | HSPA+ | 835 | No | No | No | No | No | Tx1/2 | No | No | No |
| | | | HSPA+ | 1700 | No | No | No | No | No | Tx1/2 | No | No | No |
| | | | HSPA+ | 1900 | No | No | No | No | No | Tx1/2 | No | No | No |
| | | | LTE data | 710 | Tx1/2 | No | No | No | No | No | No | No | No |
| | | | LTE data | 850 | Tx1/2 | No | No | No | No | No | No | No | No |
| | | | LTE data | 1700 | Tx1/2 | No | No | No | No | No | No | No | No |
| | | | LTE data | 1900 | Tx1/2 | No | No | No | No | No | No | No | No |
| | | Cellular + 5GHz Wifi/Cellular + BT/ Cellular + 5GHz Wifi+ BT | GSM Voice | 850 | No | Tx1/2 | No | No | No | No | Tx3 | No | Tx3 |
| | | | GSM Voice | 1900 | No | Tx1/2 | No | No | No | No | | No | |
| | | | WCDMA Voice | 835 | No | No | Tx1/2 | No | No | No | | No | |
| | | | WCDMA Voice | 1700 | No | No | Tx1/2 | No | No | No | | No | |
| | | | WCDMA Voice | 1900 | No | No | Tx1/2 | No | No | No | | No | |
| | | | GPRS/ EGPRS | 850 | No | No | No | Tx1/2 | No | No | No | No | |
| | | | GPRS/ EGPRS | 1900 | No | No | No | Tx1/2 | No | No | No | No | |
| | | | DC-HSDPA | 835 | No | No | No | No | Tx1/2 | No | No | No | |
| | | | DC-HSDPA | 1700 | No | No | No | No | Tx1/2 | No | No | No | |
| | | | DC-HSDPA | 1900 | No | No | No | No | Tx1/2 | No | No | No | |
| | | | HSPA+ | 835 | No | No | No | No | No | Tx1/2 | No | No | |
| | | | HSPA+ | 1700 | No | No | No | No | No | Tx1/2 | No | No | |
| | | | HSPA+ | 1900 | No | No | No | No | No | Tx1/2 | No | No | |
| | | | LTE data | 710 | Tx1/2 | No | No | No | No | No | No | No | |
| | | | LTE data | 850 | Tx1/2 | No | No | No | No | No | No | No | |
| | | | LTE data | 1700 | Tx1/2 | No | No | No | No | No | No | No | |
| | | | LTE data | 1900 | Tx1/2 | No | No | No | No | No | No | No | |

## 7.3.3. Wireless Router (hotspot) Exposure Condition

A1428 Hotspot simultaneous transmission

| User usage | SAR Test distance | Mode | Mode of Operation | Band | LTE | WCDMA | GPRS/ EGPRS | DC-HSDPA | HSPA+ (HSDPA/HSUPA) | Wi-Fi HOTSPOT 2.4GHz Only) | BT 2.4GHz |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Hotspot | 1 cm | Cellular + 2.4GHz Wi-Fi HOTSPOT | GPRS/ EGPRS | 850 | No | No | Tx1/2 | No | No | Tx3 | No |
| | | | GPRS/ EGPRS | 1900 | No | No | Tx1/2 | No | No | | No |
| | | | DC-HSDPA | 835 | No | No | No | Tx1/2 | No | | No |
| | | | DC-HSDPA | 1700 | No | No | No | Tx1/2 | No | | No |
| | | | DC-HSDPA | 1900 | No | No | No | Tx1/2 | No | | No |
| | | | HSPA+ | 835 | No | No | No | No | Tx1/2 | | No |
| | | | HSPA+ | 1700 | No | No | No | No | Tx1/2 | | No |
| | | | HSPA+ | 1900 | No | No | No | No | Tx1/2 | | No |
| | | | LTE data | 710 | Tx1/2 | No | No | No | No | | No |
| | | | LTE data | 850 | Tx1/2 | No | No | No | No | | No |
| | | | LTE data | 1700 | Tx1/2 | No | No | No | No | | No |
| | | | LTE data | 1900 | Tx1/2 | No | No | No | No | | No |

# 8. Summary of Test Configurations

Refer to Section 17 “Antenna Location and Separation Distances” for the specific details of the antenna-to-antenna and antenna-to-edge(s) distances.

## 8.1. Head Exposure Conditions for WWAN and WiFi

Applicable to both LAT/Primary Ant. (TX1), UAT/Secondary Ant. (TX2) and WiFi/BT Ant. (TX3)

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

## 8.2. Body-worn Accessory Exposure Conditions

Applicable to both LAT/Primary Ant. (TX1), UAT/Secondary Ant. (TX2) and WiFi/BT Ant. (TX3)

| Test Configurations | Antenna-to-edge/surface | SAR Required | Note |
|---|---|---|---|
| Rear | < 25 mm | Yes | |
| Front | < 25 mm | Yes | |

## 8.3. Hotspot Mode Exposure Conditions

**For WWAN (LAT/Primary Antenna)**

| Test Configurations | Antenna-to-edge/surface | SAR Required | Note |
|---|---|---|---|
| Rear | < 25 mm | Yes | |
| Front | < 25 mm | Yes | |
| Edge 1 | >25 mm | No | SAR is not required because the distance from the antenna to the edge is > 2.5 cm as per KDB 941225 D06 Hot Spot SAR v01 |
| Edge 2 | 0 mm | Yes | |
| Edge 3 | 0 mm | Yes | |
| Edge 4 | 0 mm | Yes | |

**For WWAN (UAT/Secondary Antenna)**

| Test Configurations | Antenna-to-edge/surface | SAR Required | Note |
|---|---|---|---|
| Rear | < 25 mm | Yes | |
| Front | < 25 mm | Yes | |
| Edge 1 | 0 mm | Yes | |
| Edge 2 | 0 mm | Yes | |
| Edge 3 | >25 mm | No | SAR is not required because the distance from the antenna to the edge is > 2.5 cm as per KDB 941225 D06 Hot Spot SAR v01 |
| Edge 4 | 0 mm | Yes | |

**For WiFi**

| Test Configurations | Antenna-to-edge/surface | SAR Required | Note |
|---|---|---|---|
| Rear | < 25 mm | Yes | |
| Front | < 25 mm | Yes | |
| Edge 1 | 4.7 mm | Yes | |
| Edge 2 | 35.2 mm | Yes | |
| Edge 3 | 115.4 mm | No | SAR is not required because the distance from the antenna to the edge is > 2.5 cm as per KDB 941225 D06 Hot Spot SAR v01 |
| Edge 4 | 10.5 mm | Yes | |

**Notes:**

- Edge 1= Top Edge
- Edge 2= Left Edge
- Edge 3= Right Edge
- Edge 4= Bottom Edge

# 9. RF Output Power Measurement

## 9.1. W-CDMA Band IV

The output power is already tuned up to the maximum limit.

**Release 99**

The following tests were completed according to the test requirements outlined in section 5.2 of the 3GPP TS34.121-1 specification. The DUT supports power Class 3, which has a nominal maximum output power of 24 dBm (+1.7/-3.7).

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

**Results**

| Band | Mode | UL Ch No. | Freq. (MHz) | Primary Antenna | Secondary Antenna |
|---|---|---|---|---|---|
| | | | | Avg Pwr (dBm) | |
| W-CDMA Band IV | Rel 99 (RMC, 12.2 kbps) | 1312 | 1712.4 | 23.0 | 21.5 |
| | | 1413 | 1732.6 | 23.0 | 21.5 |
| | | 1513 | 1752.6 | 23.0 | 21.4 |

**HSDPA**

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

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

**Results**

| Band | Mode | UL Ch No. | Freq. (MHz) | MPR | Primary Antenna | Secondary Antenna |
|---|---|---|---|---|---|---|
| | | | | | Avg Pwr (dBm) | |
| W-CDMA Band IV | Subtest 1 | 1312 | 1712.4 | 0 | 22.9 | 21.5 |
| | | 1413 | 1732.6 | 0 | 23.0 | 21.5 |
| | | 1513 | 1752.6 | 0 | 22.9 | 21.4 |
| | Subtest 2 | 1312 | 1712.4 | 1 | 23.0 | 21.4 |
| | | 1413 | 1732.6 | 1 | 23.0 | 21.4 |
| | | 1513 | 1752.6 | 1 | 23.0 | 21.4 |
| | Subtest 3 | 1312 | 1712.4 | 1.5 | 22.5 | 21.0 |
| | | 1413 | 1732.6 | 1.5 | 22.1 | 21.0 |
| | | 1513 | 1752.6 | 1.5 | 22.5 | 21.0 |
| | Subtest 4 | 1312 | 1712.4 | 1.5 | 22.5 | 20.9 |
| | | 1413 | 1732.6 | 1.5 | 22.2 | 21.0 |
| | | 1513 | 1752.6 | 1.5 | 22.5 | 20.9 |

**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 | Primary Antenna | Secondary Antenna |
|---|---|---|---|---|---|---|
| | | | | | Avg Pwr (dBm) | |
| WCDMA Band IV | Subtest 1 | 1312 | 1712.4 | 0 | 23.0 | 21.3 |
| | | 1413 | 1732.6 | 0 | 22.7 | 21.5 |
| | | 1513 | 1752.6 | 0 | 22.8 | 21.5 |
| | Subtest 2 | 1312 | 1712.4 | 2 | 21.1 | 19.6 |
| | | 1413 | 1732.6 | 2 | 20.6 | 19.5 |
| | | 1513 | 1752.6 | 2 | 20.9 | 19.4 |
| | Subtest 3 | 1312 | 1712.4 | 1 | 22.1 | 20.6 |
| | | 1413 | 1732.6 | 1 | 21.7 | 20.5 |
| | | 1513 | 1752.6 | 1 | 21.8 | 20.5 |
| | Subtest 4 | 1312 | 1712.4 | 2 | 21.0 | 19.5 |
| | | 1413 | 1732.6 | 2 | 20.6 | 19.5 |
| | | 1513 | 1752.6 | 2 | 20.8 | 19.6 |
| | Subtest 5 | 1312 | 1712.4 | 0 | 23.0 | 21.5 |
| | | 1413 | 1732.6 | 0 | 22.6 | 21.5 |
| | | 1513 | 1752.6 | 0 | 22.7 | 21.5 |

**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.<br>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. | | |

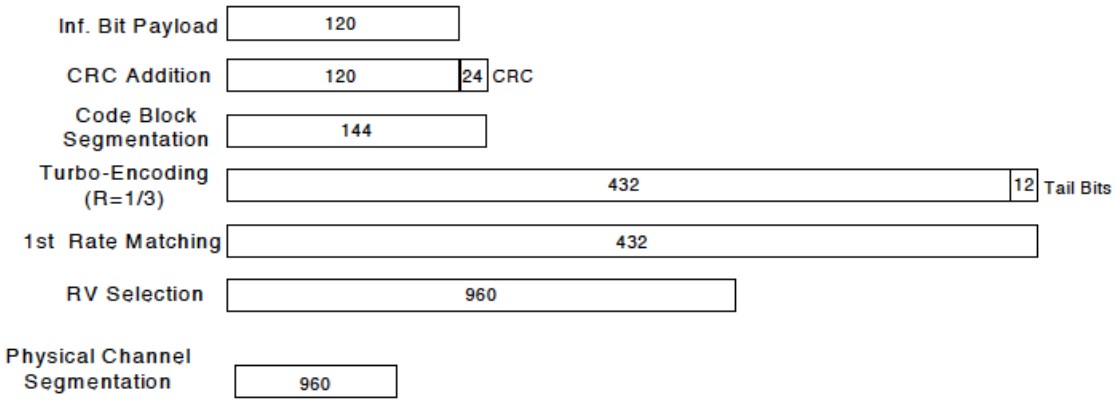



**Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)**

The following 4 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) | MPR | Primary Antenna | Secondary Antenna |
|---|---|---|---|---|---|---|
| | | | | | Avg Pwr (dBm) | |
| WCDMA Band IV | Subtest 1 | 1312 | 1712.4 | 0 | 22.9 | 21.5 |
| | | 1413 | 1732.6 | 0 | 23.0 | 21.3 |
| | | 1513 | 1752.6 | 0 | 23.0 | 21.5 |
| | Subtest 2 | 1312 | 1712.4 | 0 | 22.9 | 21.5 |
| | | 1413 | 1732.6 | 0 | 23.0 | 21.3 |
| | | 1513 | 1752.6 | 0 | 23.0 | 21.5 |
| | Subtest 3 | 1312 | 1712.4 | 0.5 | 22.5 | 20.9 |
| | | 1413 | 1732.6 | 0.5 | 22.5 | 20.9 |
| | | 1513 | 1752.6 | 0.5 | 22.5 | 21.0 |
| | Subtest 4 | 1312 | 1712.4 | 0.5 | 22.4 | 21.0 |
| | | 1413 | 1732.6 | 0.5 | 22.5 | 20.9 |
| | | 1513 | 1752.6 | 0.5 | 22.5 | 21.0 |

**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.

# 10. Tissue Dielectric Properties

### IEEE Std 1528-2003 Table 2

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

### FCC OET Bulletin 65 Supplement C 01-01 & IC RSS-102

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

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

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

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

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

**MSL/HSL750 (Body and Head liquids for 700 – 800 MHz)**

| Item | Head Tissue Simulation Liquids HSL750<br>Muscle (body) Tissue Simulation Liquids MSL750 |
|---|---|
| Type No | SL AAH 075 |
| Manufacturer | SPEAG |
| The item is composed of the following ingredients: | |
| $H^2O$ | Water, 35 – 58% |
| Sucrese | Sugar, white, refined, 40-60% |
| NaCl | Sodium Chloride, 0-6% |
| Hydroxyethel-cellulsoe | Medium Viscosity (CAS# 9004-62-0), <0.3% |
| Preventol-D7 | Preservative: aqueous preparation, (CAS# 55965-84-9), containing 5-chloro-2-methyl-3(2H)-isothiazolone and 2-methyyl-3(2H)-isothiazolone, 0.1-0.7% |

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

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

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

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

## 10.2. Tissue Dielectric Parameter Check Results

The temperature of the tissue-equivalent medium used during measurement must also be within 18°C to 25°C and within ± 2°C of the temperature when the tissue parameters are characterized.
The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 3 – 4 days of use; or earlier if the dielectric parameters can become out of tolerance; for example, when the parameters are marginal at the beginning of the measurement series.
Tissue dielectric parameters were measured at the low, middle and high frequency of each operating frequency range of the test device.

| Date | Freq. (MHz) | Liquid Parameters | | | Measured | Target | Delta (%) | Limit ±(%) |
|---|---|---|---|---|---|---|---|---|
| 12/13/2012 | Head 1750 | e' | 39.6579 | Relative Permittivity ($\epsilon_r$): | 39.66 | 40.08 | -1.06 | 5 |
| | | e'' | 13.6214 | Conductivity (σ): | 1.33 | 1.37 | -3.18 | 5 |
| | Head 1710 | e' | 39.7758 | Relative Permittivity ($\epsilon_r$): | 39.78 | 40.15 | -0.92 | 5 |
| | | e'' | 13.5276 | Conductivity (σ): | 1.29 | 1.35 | -4.47 | 5 |
| | Head 1755 | e' | 39.6412 | Relative Permittivity ($\epsilon_r$): | 39.64 | 40.08 | -1.09 | 5 |
| | | e'' | 13.6615 | Conductivity (σ): | 1.33 | 1.37 | -2.82 | 5 |
| 12/13/2012 | Body 1750 | e' | 53.2791 | Relative Permittivity ($\epsilon_r$): | 53.28 | 53.44 | -0.30 | 5 |
| | | e'' | 14.9635 | Conductivity (σ): | 1.46 | 1.49 | -2.03 | 5 |
| | Body 1710 | e' | 53.3710 | Relative Permittivity ($\epsilon_r$): | 53.37 | 53.54 | -0.32 | 5 |
| | | e'' | 14.8519 | Conductivity (σ): | 1.41 | 1.46 | -3.38 | 5 |
| | Body 1755 | e' | 53.2765 | Relative Permittivity ($\epsilon_r$): | 53.28 | 53.43 | -0.28 | 5 |
| | | e'' | 14.9984 | Conductivity (σ): | 1.46 | 1.49 | -1.72 | 5 |
| 12/18/2012 | Head 1750 | e' | 40.7016 | Relative Permittivity ($\epsilon_r$): | 40.70 | 40.08 | 1.54 | 5 |
| | | e'' | 13.6409 | Conductivity (σ): | 1.33 | 1.37 | -3.04 | 5 |
| | Head 1710 | e' | 40.8868 | Relative Permittivity ($\epsilon_r$): | 40.89 | 40.15 | 1.84 | 5 |
| | | e'' | 13.5107 | Conductivity (σ): | 1.28 | 1.35 | -4.59 | 5 |
| | Head 1755 | e' | 40.6692 | Relative Permittivity ($\epsilon_r$): | 40.67 | 40.08 | 1.48 | 5 |
| | | e'' | 13.6617 | Conductivity (σ): | 1.33 | 1.37 | -2.82 | 5 |
| 12/18/2012 | Body 1750 | e' | 52.2595 | Relative Permittivity ($\epsilon_r$): | 52.26 | 53.44 | -2.21 | 5 |
| | | e'' | 14.9793 | Conductivity (σ): | 1.46 | 1.49 | -1.92 | 5 |
| | Body 1710 | e' | 52.4379 | Relative Permittivity ($\epsilon_r$): | 52.44 | 53.54 | -2.07 | 5 |
| | | e'' | 14.8543 | Conductivity (σ): | 1.41 | 1.46 | -3.36 | 5 |
| | Body 1755 | e' | 52.2513 | Relative Permittivity ($\epsilon_r$): | 52.25 | 53.43 | -2.20 | 5 |
| | | e'' | 15.0254 | Conductivity (σ): | 1.47 | 1.49 | -1.54 | 5 |
| 12/27/2012 | Head 1750 | e' | 38.6815 | Relative Permittivity ($\epsilon_r$): | 38.68 | 40.08 | -3.50 | 5 |
| | | e'' | 13.7114 | Conductivity (σ): | 1.33 | 1.37 | -2.54 | 5 |
| | Head 1710 | e' | 38.8533 | Relative Permittivity ($\epsilon_r$): | 38.85 | 40.15 | -3.22 | 5 |
| | | e'' | 13.6220 | Conductivity (σ): | 1.30 | 1.35 | -3.80 | 5 |
| | Head 1755 | e' | 38.6472 | Relative Permittivity ($\epsilon_r$): | 38.65 | 40.08 | -3.57 | 5 |
| | | e'' | 13.7273 | Conductivity (σ): | 1.34 | 1.37 | -2.35 | 5 |

# 11. System Performance Check

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

## 11.1. System Performance Check Measurement Conditions

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

## 11.2. Reference SAR Values for System Performance Check

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

| System Dipole | Serial No. | Cal. Date | Freq. (MHz) | Target SAR Values (mW/g) | | |
|---|---|---|---|---|---|---|
| | | | | 1g/10g | Head | Body |
| D1750V2 | 1053 | 8/14/12 | 1750 | 1g | 35.9 | 37.5 |
| | | | | 10g | 19.1 | 20.2 |

## 11.3. System Performance Check Results

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

| Date Tested | System Dipole | | T.S. Liquid | | Measured Results | | | Target (Ref. Value) | Delta ±10 % | Est./Zoom Ratio ±3 % | Plot No. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Type | Serial # | | | Area Scan | Zoom Scan | Normalize to 1 W | | | | |
| 12/13/2012 | 1750MHz | 1053 | Head | 1g | 3.54 | 3.48 | 34.8 | 35.9 | -3.06 | 1.69 | |
| | | | | 10g | 1.92 | 1.86 | 18.6 | 19.1 | -2.62 | | |
| 12/13/2012 | 1750MHz | 1053 | Body | 1g | 3.90 | 3.89 | 38.9 | 37.5 | 3.73 | 0.26 | |
| | | | | 10g | 2.07 | 2.08 | 20.8 | 20.2 | 2.97 | | |
| 12/18/2012 | 1750MHz | 1053 | Head | 1g | 4.10 | 3.91 | 39.1 | 35.9 | **8.91** | 4.63 | 1,2 |
| | | | | 10g | 2.19 | 2.07 | 20.7 | 19.1 | 8.38 | | |
| 12/18/2012 | 1750MHz | 1053 | Body | 1g | 3.73 | 3.66 | 36.6 | 37.5 | -2.40 | 1.88 | |
| | | | | 10g | 1.93 | 1.96 | 19.6 | 20.2 | -2.97 | | |
| 12/27/2012 | 1750MHz | 1053 | Head | 1g | 3.79 | 3.70 | 37.0 | 35.9 | 3.06 | 2.37 | |
| | | | | 10g | 2.03 | 1.97 | 19.7 | 19.1 | 3.14 | | |

# 12. SAR Test Results

## 12.1. W-CDMA Band IV

**Test 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

### 12.1.1. Head Exposure Conditions

| Test Position | Mode | Antenna | Ch #. | Freq. (MHz) | Power (dBm) | | 1-g SAR (W/kg) | | Plot No. | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Tune-up limit | Meas. | Meas. | Scaled | | |
| Left Touch | Rel 99 RMC 12.2kbps | Primary | 1312 | 1712.4 | 23.0 | 23.0 | | | | 1 |
| | | | 1413 | 1732.6 | 23.0 | 23.0 | 0.634 | 0.634 | 1 | |
| | | | 1513 | 1752.6 | 23.0 | 23.0 | | | | 1 |
| Left Tilt (15°) | Rel 99 RMC 12.2kbps | Primary | 1312 | 1712.4 | 23.0 | 23.0 | | | | 1 |
| | | | 1413 | 1732.6 | 23.0 | 23.0 | 0.295 | 0.295 | 2 | |
| | | | 1513 | 1752.6 | 23.0 | 23.0 | | | | 1 |
| Right Touch | Rel 99 RMC 12.2kbps | Primary | 1312 | 1712.4 | 23.0 | 23.0 | 0.757 | 0.757 | 3 | |
| | | | 1413 | 1732.6 | 23.0 | 23.0 | 1.060 | **1.060** | 4 | |
| | | | 1513 | 1752.6 | 23.0 | 23.0 | 0.910 | 0.910 | 5 | |
| Right Tilt (15°) | Rel 99 RMC 12.2kbps | Primary | 1312 | 1712.4 | 23.0 | 23.0 | | | | 1 |
| | | | 1413 | 1732.6 | 23.0 | 23.0 | 0.216 | 0.216 | 6 | |
| | | | 1513 | 1752.6 | 23.0 | 23.0 | | | | 1 |
| Test Position | Mode | Antenna | Ch #. | Freq. (MHz) | Power (dBm) | | 1-g SAR (W/kg) | | Plot No. | Note |
| | | | | | Tune-up limit | Meas. | Meas. | Scaled | | |
| Left Touch | Rel 99 RMC 12.2kbps | Secondary | 1312 | 1712.4 | 21.5 | 21.5 | | | | 1 |
| | | | 1413 | 1732.6 | 21.5 | 21.5 | 0.662 | 0.662 | 7 | |
| | | | 1513 | 1752.6 | 21.4 | 21.4 | | | | 1 |
| Left Tilt (15°) | Rel 99 RMC 12.2kbps | Secondary | 1312 | 1712.4 | 21.5 | 21.5 | | | | 1 |
| | | | 1413 | 1732.6 | 21.5 | 21.5 | 0.735 | 0.735 | 8 | |
| | | | 1513 | 1752.6 | 21.4 | 21.4 | | | | 1 |
| Right Touch | Rel 99 RMC 12.2kbps | Secondary | 1312 | 1712.4 | 21.5 | 21.5 | 0.922 | 0.922 | 9 | |
| | | | 1413 | 1732.6 | 21.5 | 21.5 | 0.953 | 0.953 | 10 | |
| | | | 1513 | 1752.6 | 21.4 | 21.4 | 0.804 | 0.804 | 11 | |
| Right Tilt (15°) | Rel 99 RMC 12.2kbps | Secondary | 1312 | 1712.4 | 21.5 | 21.5 | 0.774 | 0.774 | 12 | |
| | | | 1413 | 1732.6 | 21.5 | 21.5 | 0.824 | 0.824 | 13 | |
| | | | 1513 | 1752.6 | 21.4 | 21.4 | 0.594 | 0.594 | 14 | |

**Note(s):**

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

## 12.1.2. Body-worn Accessory & Hotspot Mode Exposure Conditions

| Test Position | Mode | Antenna | Dist. (mm) | Ch #. | Freq. (MHz) | Power (dBm) | | 1-g SAR (W/kg) | | Plot No. | Note |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Tune-up limit | Meas. | Meas. | Scaled | | |
| Rear | Rel 99 RMC 12.2kbps | Primary | 10 | 1312 | 1712.4 | 23.0 | 23.0 | 0.580 | 0.580 | 15 | |
| | | | | 1413 | 1732.6 | 23.0 | 23.0 | 0.933 | 0.933 | 16 | |
| | | | | 1513 | 1752.6 | 23.0 | 23.0 | 0.829 | 0.829 | 17 | |
| Front | Rel 99 RMC 12.2kbps | Primary | 10 | 1312 | 1712.4 | 23.0 | 23.0 | 0.609 | 0.609 | 18 | |
| | | | | 1413 | 1732.6 | 23.0 | 23.0 | 0.977 | **0.977** | 19 | |
| | | | | 1413 | 1732.6 | 23.0 | 23.0 | 0.571 | 0.571 | 20 | 2 |
| | | | | 1513 | 1752.6 | 23.0 | 23.0 | 0.772 | 0.772 | 21 | |
| Edge 2 | Rel 99 RMC 12.2kbps | Primary | 10 | 1312 | 1712.4 | 23.0 | 23.0 | | | | 1 |
| | | | | 1413 | 1732.6 | 23.0 | 23.0 | 0.606 | 0.606 | 22 | |
| | | | | 1513 | 1752.6 | 23.0 | 23.0 | | | | 1 |
| Edge 3 | Rel 99 RMC 12.2kbps | Primary | 10 | 1312 | 1712.4 | 23.0 | 23.0 | 0.480 | 0.480 | 23 | |
| | | | | 1413 | 1732.6 | 23.0 | 23.0 | 0.861 | 0.861 | 24 | |
| | | | | 1513 | 1752.6 | 23.0 | 23.0 | 0.758 | 0.758 | 25 | |
| Edge 4 | Rel 99 RMC 12.2kbps | Primary | 10 | 1312 | 1712.4 | 23.0 | 23.0 | | | | 1 |
| | | | | 1413 | 1732.6 | 23.0 | 23.0 | 0.051 | 0.051 | 26 | |
| | | | | 1513 | 1752.6 | 23.0 | 23.0 | | | | 1 |
| Test Position | Mode | Antenna | Dist. (mm) | Ch #. | Freq. (MHz) | Power (dBm) | | 1-g SAR (W/kg) | | Plot No. | Note |
| | | | | | | Tune-up limit | Meas. | Meas. | Scaled | | |
| Rear | Rel 99 RMC 12.2kbps | Secondary | 10 | 1312 | 1712.4 | 21.5 | 21.5 | | | | 1 |
| | | | | 1413 | 1732.6 | 21.5 | 21.5 | 0.350 | 0.350 | 27 | |
| | | | | 1413 | 1732.6 | 21.5 | 21.5 | 0.231 | 0.231 | 28 | 2 |
| | | | | 1513 | 1752.6 | 21.4 | 21.4 | | | | 1 |
| Front | Rel 99 RMC 12.2kbps | Secondary | 10 | 1312 | 1712.4 | 21.5 | 21.5 | | | | 1 |
| | | | | 1413 | 1732.6 | 21.5 | 21.5 | 0.284 | 0.284 | 29 | |
| | | | | 1513 | 1752.6 | 21.4 | 21.4 | | | | 1 |
| Edge 1 | Rel 99 RMC 12.2kbps | Secondary | 10 | 1312 | 1712.4 | 21.5 | 21.5 | | | | 1 |
| | | | | 1413 | 1732.6 | 21.5 | 21.5 | 0.300 | 0.300 | 30 | |
| | | | | 1513 | 1752.6 | 21.4 | 21.4 | | | | 1 |
| Edge 2 | Rel 99 RMC 12.2kbps | Secondary | 10 | 1312 | 1712.4 | 21.5 | 21.5 | | | | 1 |
| | | | | 1413 | 1732.6 | 21.5 | 21.5 | 0.039 | 0.039 | 31 | |
| | | | | 1513 | 1752.6 | 21.4 | 21.4 | | | | 1 |
| Edge 4 | Rel 99 RMC 12.2kbps | Secondary | 10 | 1312 | 1712.4 | 21.5 | 21.5 | | | | 1 |
| | | | | 1413 | 1732.6 | 21.5 | 21.5 | 0.169 | 0.169 | 32 | |
| | | | | 1513 | 1752.6 | 21.4 | 21.4 | | | | 1 |

**Note(s):**

1. According to KDB 447498, Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz.
2. With headset attached. (The difference between the SAR values of the primary antenna without the headset and with the headset is dramatic, but this has been verified to be true through repeated testing)

# 13. Summary of Highest SAR Values

Results for highest SAR values for each frequency band and mode

| Technology/Band | Test configuration | | Mode | Antenna | Highest 1g SAR (W/kg) |
|---|---|---|---|---|---|
| W-CDMA Band IV | Head | Right Touch | Rel 99 RMC 12.2kbps | Primary | 1.060 |
| | Body & Hotspot | Front | Rel 99 RMC 12.2kbps | Primary | 0.977 |

## 13.1. SAR Measurement Variability and Uncertainty

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

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

| Wireless Technologies | Test Configuration | | Mode | Dist. (mm) | Ch #. | Freq. (MHz) | Meas. SAR (W/kg) | | Largest to Smallest SAR Ratio | Plot No. | Note |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Exposure | Position | | | | | Original | Repeated | | | |
| W-CDMA Band IV | Head | Right Touch | Rel. 99 RMC 12.2kbps | 10 | 1413 | 1732.6 | 1.060 | 1.040 | 1.02 | 1 | 2 |

**Note(s):**

1. Second Repeated Measurement is not required since the ratio of the largest to smallest SAR for the original and first repeated measurement is not > 1.20.
2. Repeated measurement was performed on the highest measured SAR configuration in each frequency band only.

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

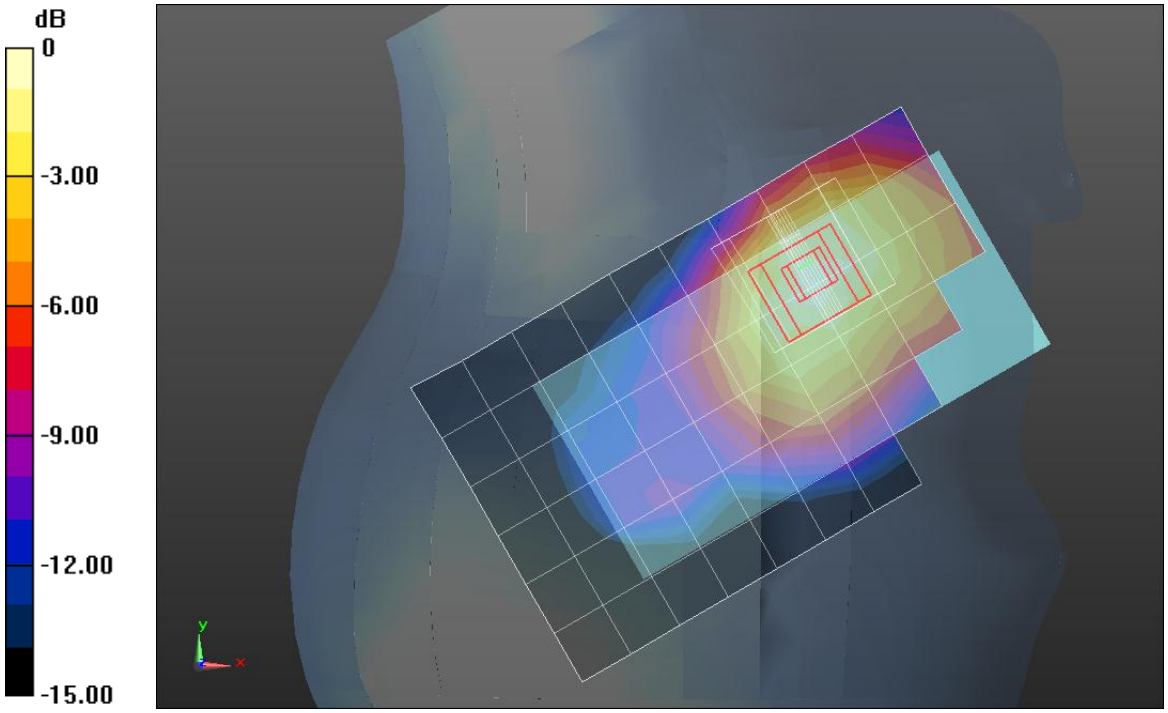
Test Laboratory: UL CCS SAR Lab C Date: 12/13/2012

### W-CDMA Band IV (Primary Antenna)

Frequency: 1732.6 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C
Medium parameters used (interpolated): f = 1732.6 MHz; $\sigma$ = 1.311 mho/m; $\varepsilon_r$ = 39.702; $\rho$ = 1000 kg/m$^3$
DASY5 Configuration:
- Area Scan Setting: Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Electronics: DAE4 Sn1239; Calibrated: 6/6/2012
- Probe: EX3DV4 - SN3773; ConvF(7.89, 7.89, 7.89); Calibrated: 3/14/2012;
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: SAM; Type: QD000P40CD; Serial: 1632

**RHS/Touch_R99_ch 1413/Area Scan (7x11x1):** Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.21 W/kg

**RHS/Touch_R99_ch 1413/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 31.231 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 1.54 W/kg
**SAR(1 g) = 1.06 W/kg; SAR(10 g) = 0.678 W/kg**
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.26 W/kg




0 dB = 1.26 W/kg = 1.00 dBW/kg

Test Laboratory: UL CCS SAR Lab C
Date: 12/14/2012

## W-CDMA Band IV (Primary Antenna)

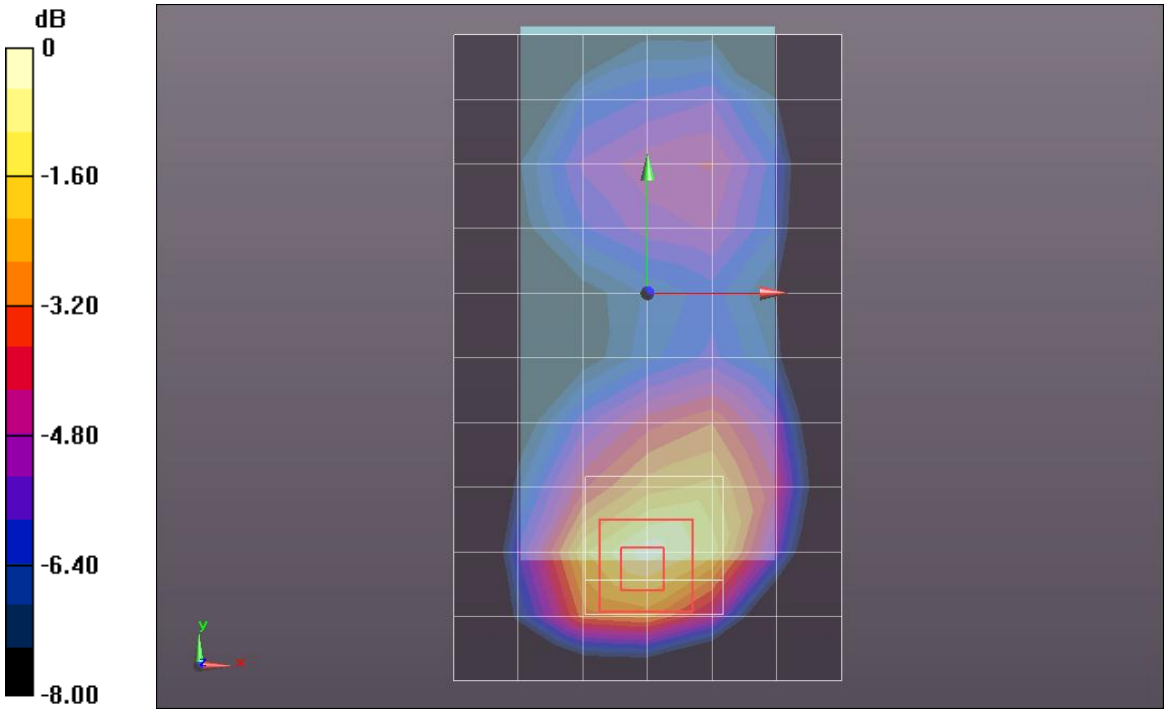
Frequency: 1732.6 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C
Medium parameters used (interpolated): f = 1732.6 MHz; $\sigma$ = 1.433 mho/m; $\varepsilon_r$ = 53.28; $\rho$ = 1000 kg/m$^3$
DASY5 Configuration:
- Area Scan Setting: Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Electronics: DAE4 Sn1239; Calibrated: 6/6/2012
- Probe: EX3DV4 - SN3773; ConvF(7.37, 7.37, 7.37); Calibrated: 3/14/2012;
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: ELI v5.0 (A); Type: QDOVA001BB; Serial: 1117

### Front/R99_ch 1413/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.15 W/kg

### Front/R99_ch 1413/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 6.675 V/m; Power Drift = 0.14 dB
Peak SAR (extrapolated) = 1.58 W/kg
**SAR(1 g) = 0.977 W/kg; SAR(10 g) = 0.568 W/kg**
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.20 W/kg




0 dB = 1.20 W/kg = 0.79 dBW/kg

# 14. Simultaneous Transmission SAR Analysis

KDB 447498 D01 General RF Exposure Guidance v05, introduces a new formula for calculating the SAR to Peak Location Ratio (SPLSR) between pairs of simultaneously transmitting antennas:

$$SPLSR = (SAR_1 + SAR_2)^{1.5} / Ri$$

Where:

$SAR_1$ is the highest measured or estimated SAR for the first of a pair of simultaneous transmitting antennas, in a specific test operating mode and exposure condition

$SAR_2$ is the highest measured or estimated SAR for the second of a pair of simultaneous transmitting antennas, in the same test operating mode and exposure condition as the first

***Ri*** is the separation distance between the pair of simultaneous transmitting antennas. When the SAR is measured, for both antennas in the pair, it is determined by the actual x, y and z coordinates in the 1-g SAR for each SAR peak location, based on the extrapolated and interpolated result in the zoom scan measurement, using the formula of $[(x_1-x_2)^2 + (y_1-y_2)^2 + (z_1-z_2)^2]$

A new threshold of 0.04 is also introduced in the KDB. Thus, in order for a pair of simultaneous transmitting antennas with the sum of 1-g SAR > 1.6 W/kg to qualify for exemption from Simultaneous Transmission SAR measurements, it has to satisfy the condition of:

$$(SAR_1 + SAR_2)^{1.5} / Ri < 0.04$$

## 14.1. Head Exposure Conditions

WiFi max. 1g SAR from SAR report "11U14136-7A1 FCC SAR Report" submitted under FCC ID: BCG-E2599A (APPLE INC).

### 14.1.1. Sum of the SAR for W-CDMA & WiFi 2.4GHz Band

**Sum of the SAR with Measured Values (Primary Antenna)**

| Test Position | Voice | Data | ∑ 1-g SAR (mW/g) |
|---|---|---|---|
| | W-CDMA Band IV | WiFi 2.4 GHz | |
| Left Touch | 0.634 | 0.205 | 0.839 |
| Left Tilt | 0.295 | 0.131 | 0.426 |
| Right Touch | 1.060 | 0.572 | 1.632 |
| Right Tilt | 0.216 | 0.326 | 0.542 |

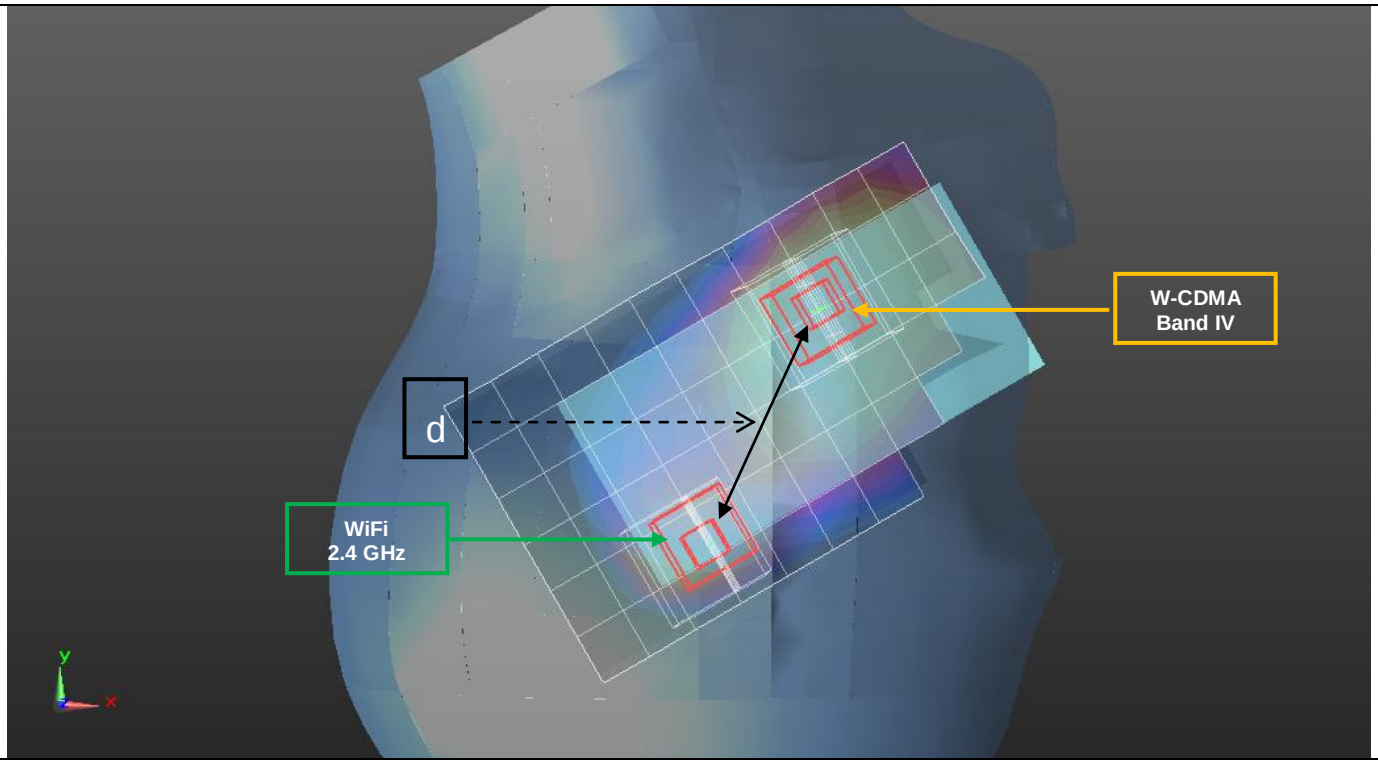
**SAR to Peak Location Separation Ratio (SPLSR)**

| Case # | Test Position | Worst-case combination | | ∑ 1-g SAR (mW/g) | Calculated distance (mm) | SPLSR* | Fig. |
|---|---|---|---|---|---|---|---|
| | | W-CDMA Band IV | WiFi 2.4 GHz | | | | |
| 1 | Right Touch | 1.060 | 0.572 | 1.632 | 79.8 | 0.026 | 1 |

**Conclusion:**

Simultaneous transmission SAR measurement (Volume Scan) is not required because either the sum of the 1-g SAR is < 1.6 W/kg or the SPLSR is < 0.04 for all circumstances that require SPLSR calculation.

**Figure (1)**




| Mode | Peak SAR | X | Y | Z |
|---|---|---|---|---|
| | mW/g | m | m | m |
| W-CDMA Band IV | 1.26 | 0.0644 | -0.256 | -0.172 |
| WiFi 2.4 GHz | 0.833 | 0.0322 | -0.329 | -0.173 |

| d: Calculated distance (mm) |
|---|
| 79.8 |

The Peak Location Separation Distance is computed by using the formula below:
SQRT((X1-X2)^2+(Y1-Y2)^2+(Z1-Z2)^2)

**Sum of the SAR with Measured Values (Secondary Antenna)**

| Test Position | Voice | Data | ∑ 1-g SAR (mW/g) |
|---|---|---|---|
| | W-CDMA Band IV | WiFi 2.4 GHz | |
| Left Touch | 0.662 | 0.205 | 0.867 |
| Left Tilt | 0.735 | 0.131 | 0.866 |
| Right Touch | 0.953 | 0.572 | 1.525 |
| Right Tilt | 0.824 | 0.326 | 1.150 |

**SAR to Peak Location Separation Ratio (SPLSR)**

As the Sum of the SAR is not greater than 1.6 W/kg SPLSR assessment is not required.

**Conclusion:**

Simultaneous transmission SAR measurement (Volume Scan) is not required because the either sum of the 1-g SAR is < 1.6 W/kg or the SPLSR is < 0.04 for all circumstances that require SPLSR calculation.

### 14.1.2. Sum of the SAR for W-CDMA & WiFi 5.2 GHz Band

**Sum of the SAR with Measured Values (Primary Antenna)**

| Test Position | Voice | Data | ∑ 1-g SAR (mW/g) |
|---|---|---|---|
| | W-CDMA Band IV | WiFi 5.2 GHz | |
| Left Touch | 0.634 | 0.440 | 1.074 |
| Left Tilt | 0.295 | 0.471 | 0.766 |
| Right Touch | 1.060 | 0.594 | 1.654 |
| Right Tilt | 0.216 | 0.566 | 0.782 |

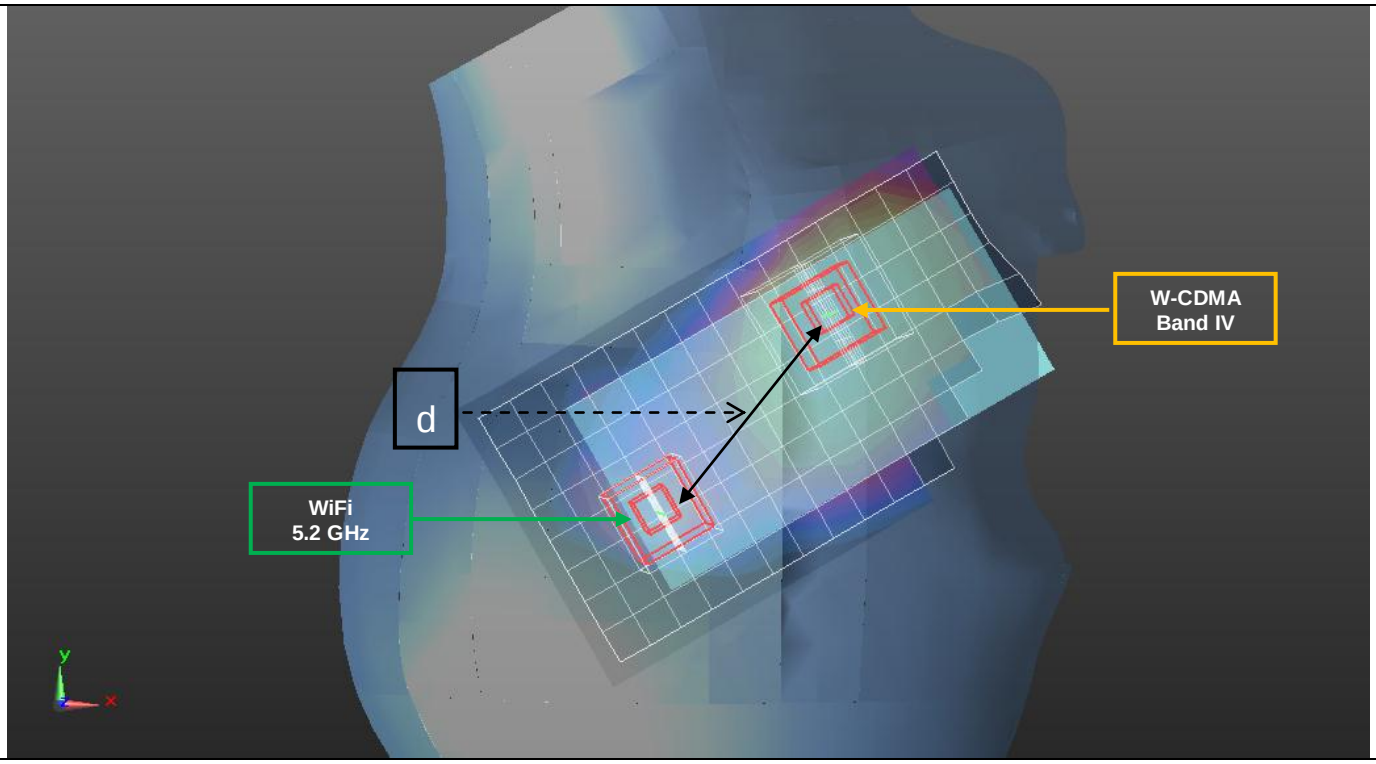
**SAR to Peak Location Separation Ratio (SPLSR)**

| Case # | Test Position | Worst-case combination | | ∑ 1-g SAR (mW/g) | Calculated distance (mm) | SPLSR (≤ 0.04) | Figure |
|---|---|---|---|---|---|---|---|
| | | W-CDMA Band IV | WiFi 5.2 GHz | | | | |
| 2 | Right Touch | 1.060 | 0.594 | 1.654 | 79.3 | 0.027 | 2 |

**Conclusion:**

Simultaneous transmission SAR measurement (Volume Scan) is not required because either the sum of the 1-g SAR is < 1.6 W/kg or the SPLSR is < 0.04 for all circumstances that require SPLSR calculation.

**Figure (2)**




| Mode | Peak SAR | X | Y | Z |
|---|---|---|---|---|
| | mW/g | m | m | m |
| W-CDMA Band IV | 1.26 | 0.0644 | -0.256 | -0.172 |
| WiFi 5.2 GHz | 1.24 | 0.0149 | -0.318 | -0.171 |

| d: Calculated distance (mm) |
|---|
| 79.3 |

The Peak Location Separation Distance is computed by using the formula below:
SQRT((X1-X2)^2+(Y1-Y2)^2+(Z1-Z2)^2)

**Sum of the SAR with Measured Values (Secondary Antenna)**

| Test Position | Voice | Data | ∑ 1-g SAR (mW/g) |
|---|---|---|---|
| | W-CDMA Band IV | WiFi 5.2 GHz | |
| Left Touch | 0.662 | 0.440 | 1.102 |
| Left Tilt | 0.735 | 0.471 | 1.206 |
| Right Touch | 0.953 | 0.594 | 1.547 |
| Right Tilt | 0.824 | 0.566 | 1.390 |

**SAR to Peak Location Separation Ratio (SPLSR)**

As the Sum of the SAR is not greater than 1.6 W/kg SPLSR assessment is not required.

**Conclusion:**

Simultaneous transmission SAR measurement (Volume Scan) is not required because the either sum of the 1-g SAR is < 1.6 W/kg or the SPLSR is < 0.04 for all circumstances that require SPLSR calculation.

### 14.1.3. Sum of the SAR for W-CDMA & WiFi 5.3 GHz Band

**Sum of the SAR with Measured Values (Primary Antenna)**

| Test Position | Voice | Data | ∑ 1-g SAR (mW/g) |
|---|---|---|---|
| | W-CDMA Band IV | WiFi 5.3 GHz | |
| Left Touch | 0.634 | 0.384 | 1.018 |
| Left Tilt | 0.295 | 0.350 | 0.645 |
| Right Touch | 1.060 | 0.538 | 1.598 |
| Right Tilt | 0.216 | 0.474 | 0.690 |

**SAR to Peak Location Separation Ratio (SPLSR)**

As the Sum of the SAR is not greater than 1.6 W/kg SPLSR assessment is not required.

**Conclusion:**

Simultaneous transmission SAR measurement (Volume Scan) is not required because the either sum of the 1-g SAR is < 1.6 W/kg or the SPLSR is < 0.04 for all circumstances that require SPLSR calculation.

**Sum of the SAR with Measured Values (Secondary Antenna)**

| Test Position | Voice | Data | ∑ 1-g SAR (mW/g) |
|---|---|---|---|
| | W-CDMA Band IV | WiFi 5.3 GHz | |
| Left Touch | 0.662 | 0.384 | 1.046 |
| Left Tilt | 0.735 | 0.350 | 1.085 |
| Right Touch | 0.953 | 0.538 | 1.491 |
| Right Tilt | 0.824 | 0.474 | 1.298 |

**SAR to Peak Location Separation Ratio (SPLSR)**

As the Sum of the SAR is not greater than 1.6 W/kg SPLSR assessment is not required.

**Conclusion:**

Simultaneous transmission SAR measurement (Volume Scan) is not required because the either sum of the 1-g SAR is < 1.6 W/kg or the SPLSR is < 0.04 for all circumstances that require SPLSR calculation.

### 14.1.4. Sum of the SAR for W-CDMA & WiFi 5.5 GHz Band

**Sum of the SAR with Measured Values (Primary Antenna)**

| Test Position | Voice | Data | ∑ 1-g SAR (mW/g) |
|---|---|---|---|
| | W-CDMA Band IV | WiFi 5.5 GHz | |
| Left Touch | 0.634 | 0.492 | 1.126 |
| Left Tilt | 0.295 | 0.530 | 0.825 |
| Right Touch | 1.060 | 0.593 | 1.653 |
| Right Tilt | 0.216 | 0.579 | 0.795 |

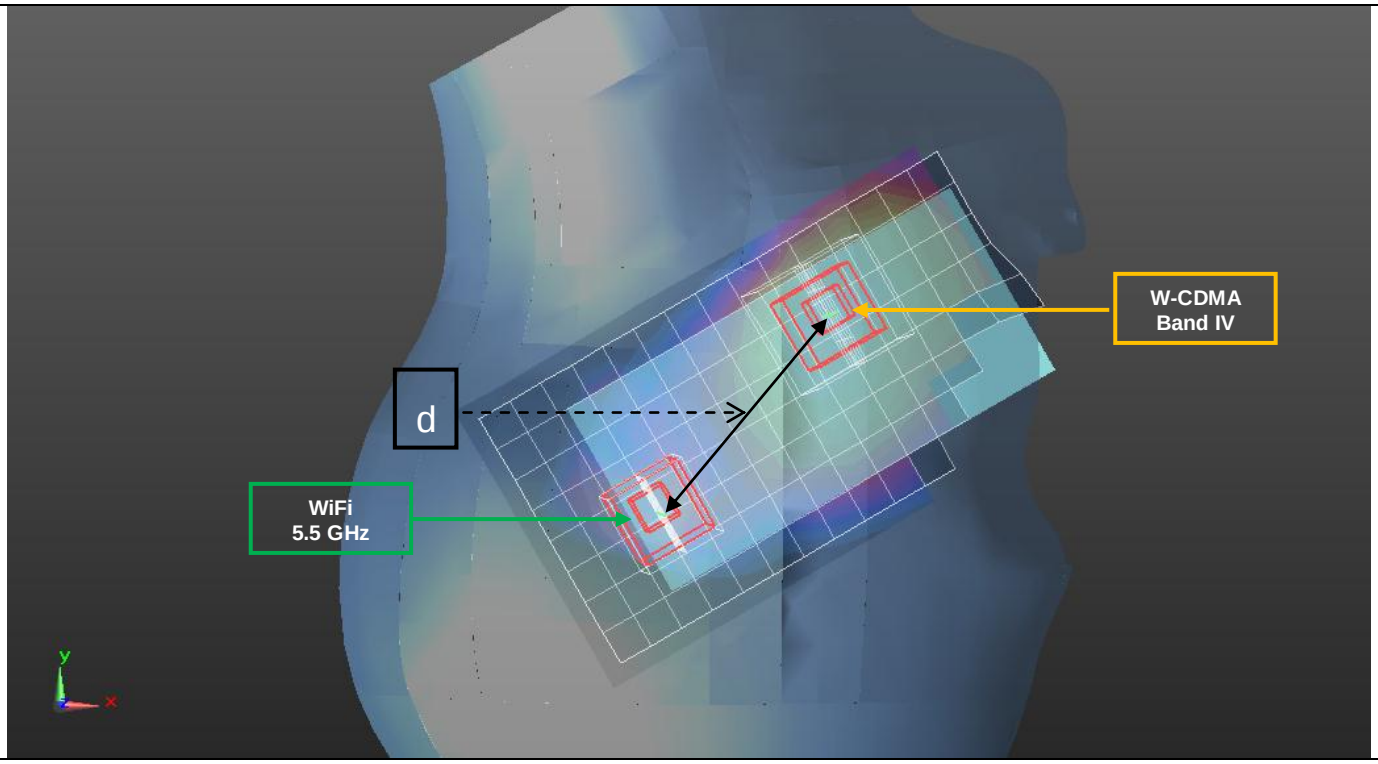
**SAR to Peak Location Separation Ratio (SPLSR)**

| Case # | Test Position | Worst-case combination | | ∑ 1-g SAR (mW/g) | Calculated distance (mm) | SPLSR (≤ 0.04) | Figure |
|---|---|---|---|---|---|---|---|
| | | W-CDMA Band IV | WiFi 5.5 GHz | | | | |
| 3 | Right Touch | 1.060 | 0.593 | 1.653 | 79.3 | 0.027 | 3 |

**Conclusion:**

Simultaneous transmission SAR measurement (Volume Scan) is not required because the either sum of the 1-g SAR is < 1.6 W/kg or the SPLSR is < 0.04 for all circumstances that require SPLSR calculation.

**Figure (3)**




| Mode | Peak SAR | X | Y | Z |
|---|---|---|---|---|
| | mW/g | m | m | m |
| W-CDMA Band IV | 1.26 | 0.0644 | -0.256 | -0.172 |
| WiFi 5.5 GHz | 1.31 | 0.0149 | -0.318 | -0.171 |

| d: Calculated distance (mm) |
|---|
| 79.3 |

The Peak Location Separation Distance is computed by using the formula below:
SQRT((X1-X2)^2+(Y1-Y2)^2+(Z1-Z2)^2)

**Sum of the SAR with Measured Values (Secondary Antenna)**

| Test Position | Voice | Data | ∑ 1-g SAR (mW/g) |
|---|---|---|---|
| | W-CDMA Band IV | WiFi 5.5 GHz | |
| Left Touch | 0.662 | 0.492 | 1.154 |
| Left Tilt | 0.735 | 0.530 | 1.265 |
| Right Touch | 0.953 | 0.593 | 1.546 |
| Right Tilt | 0.824 | 0.579 | 1.403 |

**SAR to Peak Location Separation Ratio (SPLSR)**

As the Sum of the SAR is not greater than 1.6 W/kg SPLSR assessment is not required.

**Conclusion:**

Simultaneous transmission SAR measurement (Volume Scan) is not required because the either sum of the 1-g SAR is < 1.6 W/kg or the SPLSR is < 0.04 for all circumstances that require SPLSR calculation.

### 14.1.5. Sum of the SAR for W-CDMA & WiFi 5.8 GHz Band

**Sum of the SAR with Measured Values (Primary Antenna)**

| Test Position | Voice | Data | ∑ 1-g SAR (mW/g) |
|---|---|---|---|
| | W-CDMA Band IV | WiFi 5.8 GHz | |
| Left Touch | 0.634 | 0.559 | 1.193 |
| Left Tilt | 0.295 | 0.546 | 0.841 |
| Right Touch | 1.060 | 0.580 | 1.640 |
| Right Tilt | 0.216 | 0.577 | 0.793 |

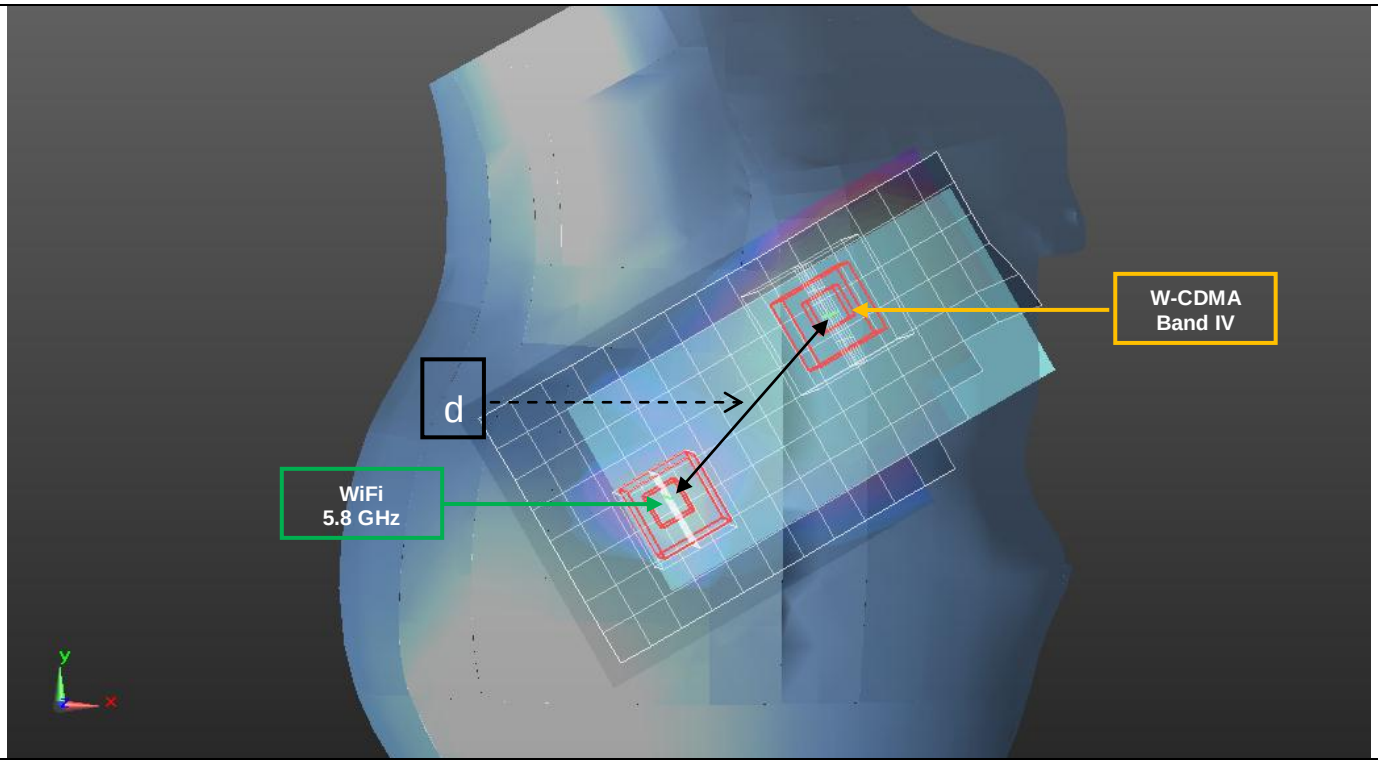
**SAR to Peak Location Separation Ratio (SPLSR)**

| Case # | Test Position | Worst-case combination | | ∑ 1-g SAR (mW/g) | Calculated distance (mm) | SPLSR (≤ 0.04) | Figure |
|---|---|---|---|---|---|---|---|
| | | W-CDMA Band IV | WiFi 2.4 GHz | | | | |
| 4 | Right Touch | 1.060 | 0.580 | 1.640 | 75.0 | 0.028 | 4 |

**Conclusion:**

Simultaneous transmission SAR measurement (Volume Scan) is not required because the either sum of the 1-g SAR is < 1.6 W/kg or the SPLSR is < 0.04 for all circumstances that require SPLSR calculation.

**Figure (4)**




| Mode | Peak SAR | X | Y | Z |
|---|---|---|---|---|
| | mW/g | m | m | m |
| W-CDMA Band IV | 1.26 | 0.0644 | -0.256 | -0.173 |
| WiFi 5.8 GHz | 1.27 | 0.0168 | -0.314 | -0.172 |

| d: Calculated distance (mm) |
|---|
| 75.0 |

The Peak Location Separation Distance is computed by using the formula below:
SQRT((X1-X2)^2+(Y1-Y2)^2+(Z1-Z2)^2)

**Sum of the SAR with Measured Values (Secondary Antenna)**

| Test Position | Voice | Data | ∑ 1-g SAR (mW/g) |
|---|---|---|---|
| | W-CDMA Band IV | WiFi 5.8 GHz | |
| Left Touch | 0.662 | 0.559 | 1.221 |
| Left Tilt | 0.735 | 0.546 | 1.281 |
| Right Touch | 0.953 | 0.580 | 1.533 |
| Right Tilt | 0.824 | 0.577 | 1.401 |

**SAR to Peak Location Separation Ratio (SPLSR)**

As the Sum of the SAR is not greater than 1.6 W/kg SPLSR assessment is not required.

**Conclusion:**

Simultaneous transmission SAR measurement (Volume Scan) is not required because the either sum of the 1-g SAR is < 1.6 W/kg or the SPLSR is < 0.04 for all circumstances that require SPLSR calculation.

## 14.2. Body-worn Accessory & Hotspot Mode Exposure Conditions

WiFi and BT max. 1g SAR from SAR report "11U14136-7A1 FCC SAR Report" submitted under FCC ID: BCG-E2599A (APPLE INC).

### 14.2.1.Sum of the SAR for W-CDMA & WiFi 2.4 GHz Band

**Sum of the SAR with Measured Values (Primary Antenna)**

| Test Position | Data | | ∑ 1-g SAR (mW/g) |
|---|---|---|---|
| | W-CDMA Band IV | WiFi 2.4 GHz | |
| Rear | 0.933 | 0.198 | 1.131 |
| Front | 0.977 | 0.083 | 1.060 |
| Edge 1 | 0 | 0.084 | 0.084 |
| Edge 2 | 0.606 | 0.022 | 0.628 |
| Edge 3 | 0.861 | 0 | 0.861 |
| Edge 4 | 0.051 | 0.170 | 0.221 |

**SAR to Peak Location Separation Ratio (SPLSR)**
As the Sum of the SAR is not greater than 1.6 W/kg SPLSR assessment is not required.

**Conclusion:**
Simultaneous transmission SAR measurement (Volume Scan) is not required because the either sum of the 1-g SAR is < 1.6 W/kg or the SPLSR is < 0.04 for all circumstances that require SPLSR calculation.

**Sum of the SAR with Measured Values (Secondary Antenna)**

| Test Position | Data | | ∑ 1-g SAR (mW/g) |
|---|---|---|---|
| | W-CDMA Band IV | WiFi 2.4 GHz | |
| Rear | 0.350 | 0.198 | 0.548 |
| Front | 0.284 | 0.083 | 0.367 |
| Edge 1 | 0.300 | 0.084 | 0.384 |
| Edge 2 | 0.039 | 0.022 | 0.061 |
| Edge 3 | 0 | 0 | 0 |
| Edge 4 | 0.169 | 0.170 | 0.339 |

**SAR to Peak Location Separation Ratio (SPLSR)**

As the Sum of the SAR is not greater than 1.6 W/kg SPLSR assessment is not required.

**Conclusion:**

Simultaneous transmission SAR measurement (Volume Scan) is not required because the either sum of the 1-g SAR is < 1.6 W/kg or the SPLSR is < 0.04 for all circumstances that require SPLSR calculation.

### 14.2.2.Sum of the SAR for W-CDMA, WiFi 5.2 GHz Band & Bluetooth 2.4 GHz

**Sum of the SAR with Measured Values (Primary Antenna)**

| Test Position | Data | | | ∑ 1-g SAR (mW/g) |
|---|---|---|---|---|
| | W-CDMA Band IV | WiFi 5.2 GHz | Bluetooth 2.4 GHz | |
| Rear | 0.933 | 0.050 | 0.109 | 1.092 |
| Front | 0.977 | 0.065 | 0.045 | 1.087 |

**SAR to Peak Location Separation Ratio (SPLSR)**
As the Sum of the SAR is not greater than 1.6 W/kg SPLSR assessment is not required.

**Conclusion:**
Simultaneous transmission SAR measurement (Volume Scan) is not required because the either sum of the 1-g SAR is < 1.6 W/kg or the SPLSR is < 0.04 for all circumstances that require SPLSR calculation.

**Sum of the SAR with Measured Values (Secondary Antenna)**

| Test Position | Data | | | ∑ 1-g SAR (mW/g) |
|---|---|---|---|---|
| | W-CDMA Band IV | WiFi 5.2 GHz | Bluetooth 2.4 GHz | |
| Rear | 0.350 | 0.050 | 0.109 | 0.509 |
| Front | 0.284 | 0.065 | 0.045 | 0.394 |

**SAR to Peak Location Separation Ratio (SPLSR)**

As the Sum of the SAR is not greater than 1.6 W/kg SPLSR assessment is not required.

**Conclusion:**

Simultaneous transmission SAR measurement (Volume Scan) is not required because the either sum of the 1-g SAR is < 1.6 W/kg or the SPLSR is < 0.04 for all circumstances that require SPLSR calculation.

### 14.2.3.Sum of the SAR for W-CDMA, WiFi 5.3 GHz Band & Bluetooth 2.4 GHz

**Sum of the SAR with Measured Values (Primary Antenna)**

| Test Position | Data | | | ∑ 1-g SAR (mW/g) |
|---|---|---|---|---|
| | W-CDMA Band IV | WiFi 5.3 GHz | Bluetooth 2.4 GHz | |
| Rear | 0.933 | 0.068 | 0.109 | 1.110 |
| Front | 0.977 | 0.071 | 0.045 | 1.093 |

**SAR to Peak Location Separation Ratio (SPLSR)**
As the Sum of the SAR is not greater than 1.6 W/kg SPLSR assessment is not required.

**Conclusion:**
Simultaneous transmission SAR measurement (Volume Scan) is not required because the either sum of the 1-g SAR is < 1.6 W/kg or the SPLSR is < 0.04 for all circumstances that require SPLSR calculation.

**Sum of the SAR with Measured Values (Secondary Antenna)**

| Test Position | Data | | | ∑ 1-g SAR (mW/g) |
|---|---|---|---|---|
| | W-CDMA Band IV | WiFi 5.3 GHz | Bluetooth 2.4 GHz | |
| Rear | 0.350 | 0.068 | 0.109 | 0.527 |
| Front | 0.284 | 0.071 | 0.045 | 0.400 |

**SAR to Peak Location Separation Ratio (SPLSR)**

As the Sum of the SAR is not greater than 1.6 W/kg SPLSR assessment is not required.

**Conclusion:**

Simultaneous transmission SAR measurement (Volume Scan) is not required because the either sum of the 1-g SAR is < 1.6 W/kg or the SPLSR is < 0.04 for all circumstances that require SPLSR calculation.

### 14.2.4.Sum of the SAR for W-CDMA, WiFi 5.5 GHz Band & Bluetooth 2.4 GHz

**Sum of the SAR with Measured Values (Primary Antenna)**

| Test Position | Data | | | ∑ 1-g SAR (mW/g) |
|---|---|---|---|---|
| | W-CDMA Band IV | WiFi 5.5 GHz | Bluetooth 2.4 GHz | |
| Rear | 0.933 | 0.076 | 0.109 | 1.118 |
| Front | 0.977 | 0.085 | 0.045 | 1.107 |

**SAR to Peak Location Separation Ratio (SPLSR)**
As the Sum of the SAR is not greater than 1.6 W/kg SPLSR assessment is not required.

**Conclusion:**
Simultaneous transmission SAR measurement (Volume Scan) is not required because the either sum of the 1-g SAR is < 1.6 W/kg or the SPLSR is < 0.04 for all circumstances that require SPLSR calculation.

**Sum of the SAR with Measured Values (Secondary Antenna)**

| Test Position | Data | | | ∑ 1-g SAR (mW/g) |
|---|---|---|---|---|
| | W-CDMA Band IV | WiFi 5.5 GHz | Bluetooth 2.4 GHz | |
| Rear | 0.350 | 0.076 | 0.109 | 0.535 |
| Front | 0.284 | 0.085 | 0.045 | 0.414 |

**SAR to Peak Location Separation Ratio (SPLSR)**

As the Sum of the SAR is not greater than 1.6 W/kg SPLSR assessment is not required.

**Conclusion:**

Simultaneous transmission SAR measurement (Volume Scan) is not required because the either sum of the 1-g SAR is < 1.6 W/kg or the SPLSR is < 0.04 for all circumstances that require SPLSR calculation.

### 14.2.5.Sum of the SAR for W-CDMA, WiFi 5.8 GHz Band & Bluetooth 2.4 GHz

**Sum of the SAR with Measured Values (Primary Antenna)**

| Test Position | Data | | | ∑ 1-g SAR (mW/g) |
|---|---|---|---|---|
| | W-CDMA Band IV | WiFi 5.8 GHz | Bluetooth 2.4 GHz | |
| Rear | 0.933 | 0.051 | 0.109 | 1.093 |
| Front | 0.977 | 0.067 | 0.045 | 1.089 |

**SAR to Peak Location Separation Ratio (SPLSR)**
As the Sum of the SAR is not greater than 1.6 W/kg SPLSR assessment is not required.

**Conclusion:**
Simultaneous transmission SAR measurement (Volume Scan) is not required because the either sum of the 1-g SAR is < 1.6 W/kg or the SPLSR is < 0.04 for all circumstances that require SPLSR calculation.

**Sum of the SAR with Measured Values (Secondary Antenna)**

| Test Position | Data | | | ∑ 1-g SAR (mW/g) |
|---|---|---|---|---|
| | W-CDMA Band IV | WiFi 5.8 GHz | Bluetooth 2.4 GHz | |
| Rear | 0.350 | 0.051 | 0.109 | 0.510 |
| Front | 0.284 | 0.067 | 0.045 | 0.396 |

**SAR to Peak Location Separation Ratio (SPLSR)**

As the Sum of the SAR is not greater than 1.6 W/kg SPLSR assessment is not required.

**Conclusion:**

Simultaneous transmission SAR measurement (Volume Scan) is not required because the either sum of the 1-g SAR is < 1.6 W/kg or the SPLSR is < 0.04 for all circumstances that require SPLSR calculation.

# 15. Appendixes

**Refer to separated files for the following appendixes.**

**15.1. System Performance Check Plots**

**15.2. SAR Test Plots for W-CDMA Band IV**

**15.3. SAR Test Plots for Repeatability**

**15.4. Calibration Certificate for E-Field Probe EX3DV4 - SN 3773**

**15.5. Calibration Certificate for D1750V2 - SN 1053**