**FCC 47 CFR Parts 1 & 2**
**Published RF Exposure KDB Procedures**
**IEEE Std 1528-2003 and IEEE 1528a-2005**

# SAR EVALUATION REPORT

*For*

**GSM/WCDMA/LTE Phone + Bluetooth & WLAN (2.4GHz & 5GHz) and NFC**

**Model: SHV-E470S**
**FCC ID: A3LSHVE470S**

**Report Number: 13U15753-8**
**Issue Date: 8/28/2013**

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# 1. Attestation of Test Results

| | | | | |
|---|---|---|---|---|
| Applicant | Samsung Electronics Co., Ltd. | | | |
| DUT description | GSM/WCDMA/LTE Phone + Bluetooth & WLAN (2.4GHz & 5GHz) and NFC | | | |
| Model | SHV-E470S | | | |
| Test device is | An identical prototype | | | |
| Device category | Portable | | | |
| Exposure category | General Population/Uncontrolled Exposure | | | |
| Date tested | 8/5/2013 – 8/27/2013 | | | |
| The highest reported SAR values | RF exposure condition | Licensed | DTS | UNII |
| | Head | 0.152 W/kg | 1.093 W/kg | 1.054 W/kg |
| | Body-worn Accessory | 0.492 W/kg | 0.304 W/kg | 0.287 W/kg |
| | Wireless Router (Hotspot) | 0.502 W/kg | 0.361 W/kg | N/A |
| | Simultaneous Transmission | 1.245 W/kg | 1.245 W/kg | 1.206 W/kg |
| Applicable Standards | FCC 47 CFR Parts 1 & 2<br>Published RF Exposure KDB Procedures, and TCB workshop updates<br>IEEE Std 1528-2003 and IEEE Std 1528a-2005 | | | |
| Test Results | Pass | | | |

UL Verification Services Inc. 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 Verification Services Inc. 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 Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. 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.

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# 2. Test Methodology

The tests documented in this report were performed in accordance with FCC 47 CFR Parts 1 & 2, IEEE STD 1528-2003, IEEE Std 1528a-2005, the following FCC Published RF exposure KDB procedures, and TCB workshop updates:

- 447498 D01 General RF Exposure Guidance v05r01
- 648474 D04 SAR Handsets Multi Xmiter and Ant v01r01
- 941225 D01 SAR test for 3G devices v02
- 941225 D02 HSPA and 1x Advanced v02r02
- 941225 D03 SAR Test Reduction GSM GPRS EDGE v01
- 941225 D04 SAR for GSM E GPRS Dual Xfer Mode v01
- 941225 D05 SAR for LTE Devices v02r02
- 941225 D06 Hot Spot SAR v01r01
- 248227 D01 SAR Meas for 802 11abg v01r02
- 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r01
- 865664 D02 SAR Reporting v01r01
- 690783 D01 SAR Listings on Grants v01r02
- April 2013 TCB Workshop Updates – include 802.11ac SAR for highest 802.11a configuration in each 5 GHz band and each exposure condition.

# 3. Facilities and Accreditation

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

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


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# 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.

**Tissue Dielectric Properties**

| Name of Equipment | Manufacturer | Type/Model | Serial No. | Cal. Due Date |
|---|---|---|---|---|
| Network Analyzer | Agilent | 8753ES | MY40000980 | 2/20/2014 |
| Dielectronic Probe kit | SPEAG | DAK-3.5 | 1082 | 9/18/2013 |
| Dielectronic Probe kit | SPEAG | DAK-3.5 Short | SM DAK 200 BA | N/A |
| Thermometer | Control Company | 4242 | 122529163 | 9/19/2013 |

**System Performance Check**

| Name of Equipment | Manufacturer | Type/Model | Serial No. | Cal. Due Date |
|---|---|---|---|---|
| Synthesized Signal Generator | HP | 8665B | 3744A01084 | 5/7/2014 |
| Power Meter | HP | 437B | 3125U12345 | 7/29/2014 |
| Power Sensor | HP | 8481A | 1926A27048 | 7/29/2014 |
| Power Meter | HP | 437B | 3125U09248 | 9/24/2013 |
| Power Sensor | HP | 8481A | 3318A95392 | 9/24/2013 |
| Amplifier | MITEQ | AMF-4D-00400600-50-30P | 1620606 | N/A |
| Directional coupler | Werlatone | C8060-102 | 2141 | N/A |
| DC Power Supply | AMETEK | XHR60-18 | 1318A00530 | N/A |
| Thermometer | TRACEABLE | 4242 | 122529163 | 9/19/2013 |
| E-Field Probe | SPEAG | EX3DV4 | 3929 | 6/24/2014 |
| E-Field Probe | SPEAG | EX3DV4 | 3773 | 4/26/2014 |
| E-Field Probe | SPEAG | EX3DV4 | 3902 | 7/12/2014 |
| Data Acquisition Electronics | SPEAG | DAE4 | 1259 | 2/7/2014 |
| Data Acquisition Electronics | SPEAG | DAE4 | 1359 | 2/8/2014 |
| Data Acquisition Electronics | SPEAG | DAE4 | 1377 | 7/15/2014 |
| System Validation Dipole | SPEAG | D750V2 | 1019 | 3/5/2014 |
| System Validation Dipole | SPEAG | D850V2 | 4d002 | 10/24/2013 |
| System Validation Dipole | SPEAG | D1900V2 | 5d043 | 11/6/2013 |
| System Validation Dipole | SPEAG | D2450V2 | 899 | 10/5/2013 |
| System Validation Dipole | SPEAG | D5GHzV2 | 1138 | 10/9/2013 |

**Others**

| Name of Equipment | Manufacturer | Type/Model | Serial No. | Cal. Due Date |
|---|---|---|---|---|
| Base Station Simulator | Agilent | 8960 | MY48360200 | 3/20/2014 |
| Base Station Simulator | R & S | CMU200 | 106301 | 7/3/2014 |
| Base Station Simulator | R & S | CMW500 | 132910-cp | 2/19/2014 |
| Bluetooth Tester | R & S | CBT | 100900-ac | 7/4/2014 |
| Power Meter | Agilent | N1912A | MY53040016 | 4/4/2014 |
| Power Sensor | Agilent | N1921A | MY52020011 | 5/13/2014 |

## 4.2. Measurement Uncertainty

Per KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r01 Section 2.8.1., when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg, the extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2003 is not required in SAR reports submitted for equipment approval.


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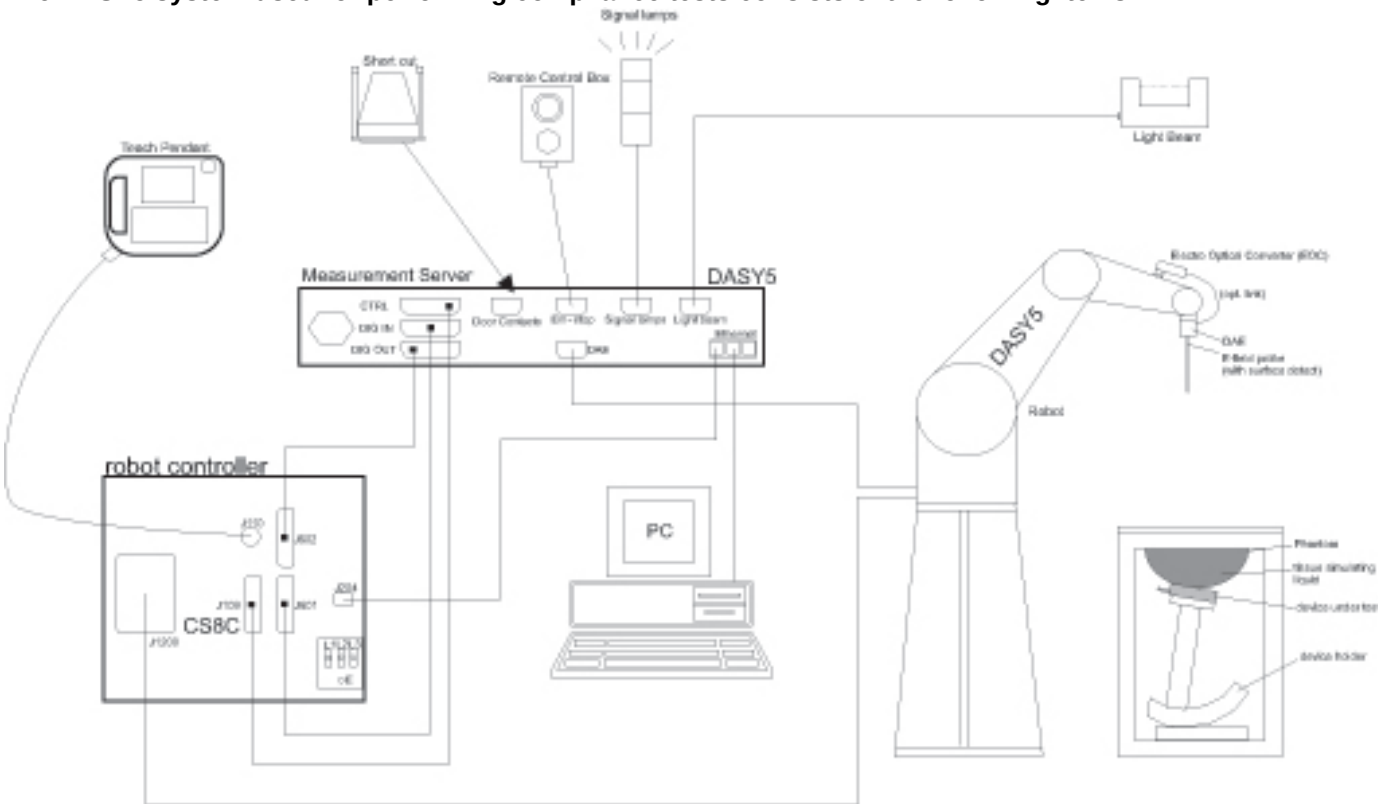
# 5. Measurement System Description and Setup

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




- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic Field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running WinXP or Win7 and the DASY5 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.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# 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 v01r01

| | ≤ 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. | |


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**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 v01r01

| | | | ≤ 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 | $\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$ | |
| 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.


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## 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.


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# 7. Device Under Test

## 7.1. General Information

| | |
|---|---|
| Operating Configuration(s) | Held to head,<br>Body-worn (Voice call) |
| Mobile Hotspot | WiFi Hotspot mode permits the device to share its cellular data connection with other WiFi-enabled devices.<br>☒ Mobile Hotspot (WiFi 2.4 GHz) ( Mobile AP, FCC: Ch.1 ~ Ch.11)<br>☒ Mobile Hotspot (WiFi 5 GHz) (Mobile AP, FCC: Ch.149~165) |
| WiFi Direct | Wi-Fi Direct enabled devices transfer data directly between each other<br>☒ WiFi Direct (WiFi 2.4 GHz) (FCC: Ch.1 ~ Ch.11)<br>☒ WiFi Direct (WiFi 5 GHz) (FCC: Ch.149~165) |
| RF Exposure Condition(s) | Head,<br>Body-worn Accessory,<br>Hotspot (wireless router) & WiFi Direct |
| Device dimension | Overall (Length x Width): 138 mm x 71 mm<br>Overall Diagonal: 146.6 mm<br>Display Diagonal: 126.9 mm |
| Accessory | Headset |
| Battery Options | ☒ Standard – Lithium-ion battery, Rating 3.8 Vdc, 9.88 Wh<br>☐ Extended (large capacity) |


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## 7.2. Wireless Technologies

| | |
|---|---|
| Wireless Technology and Frequency Bands | GSM: 1900<br>W-CDMA Band: II, V<br>LTE Band 5, 17<br>WiFi: 2.4 / 5 GHz<br>Bluetooth: 2.4 GHz. |
| Mode | GSM<br>- ☒ Voice (GMSK)<br>- ☒ GPRS (GMSK)<br>- ☒ EGPRS (8PSK) (Rx only)<br>W-CDMA<br>- ☒ UMTS Rel. 99 (Voice & Data)<br>- ☒ HSDPA (Rel. 5)<br>- ☒ HSUPA (Rel. 6)<br>- ☐ DC-HSDPA (Rel. )<br>- ☐ HSPA+ (Rel. )<br>LTE:<br>- ☒ QPSK<br>- ☒ 16QAM<br>WiFi 2.4GHz (802.11b/g/n)<br>- ☒ 802.11b<br>- ☒ 802.11g<br>- ☒ 802.11n (20MHz)<br>- ☐ 802.11n (40MHz)<br>WiFi 5GHz<br>- ☒ 802.11a<br>- ☒ 802.11n (20MHz)<br>- ☒ 802.11n (40MHz)<br>- ☒ 802.11ac (80MHz)<br>Bluetooth Ver. 4.0 (LE) |
| Duty Cycle | GSM Voice: 12.5%; GPRS 1 Slot: 12.5%; 2 Slots: 25%, 3 Slots: 37.5%,4 Slots: 50%,<br>W-CDMA: 100%<br>LTE: 100%<br>WiFi 802.11a/b/g/n/ac: 100%<br>Bluetooth: 32.25% (DH1), 66.68% (DH3), 77.52% (DH5) |
| GPRS Multi-Slot Class | ☐ Class 8 - One Up<br>☐ Class 10 - Two Up<br>☒ Class 12 - Four Up |
| Mobile Phone Capability | ☐ Class A - Mobile phones can be connected to both GPRS and GSM services simultaneously.<br>☒ Class B - Mobile phones can be attached to both GPRS and GSM services, using one service at a time.<br>☐ Class C - Mobile phones are attached to either GPRS or GSM voice service. You need to switch manually between services |
| DTM (Dual Transfer Mode) | Not Supported |
| VoIP (GPRS) | Not Supported |
| SV-LTE & SV-DO | Not Supported |


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## 7.3. Output Power Tune-up Tolerance

| Upper limit (dB): 0.5 ~ -1.5 | | RF Output Power (dBm) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Target | | | | Max. tune-up tolerance limit | | | |
| RF Air interface | Mode | 1 Slot | 2 Slot | 3 Slot | 4 Slot | 1 Slot | 2 Slot | 3 Slot | 4 Slot |
| GSM1900 | Voice | 30.0 | | | | **30.5** | | | |
| | GPRS | 30.0 | 29.0 | 28.0 | 26.0 | **30.5** | **29.5** | **28.5** | **26.5** |

| Upper limit (dB): 0.5 ~ -1.5 | | RF Output Power (dBm) | |
|---|---|---|---|
| RF Air interface | Mode | Target | Max. tune-up tolerance limit |
| W-CDMA Band V | R99 | 24.0 | **24.5** |
| | HSDPA | 23.0 | **23.5** |
| | HSUPA | 23.0 | **23.5** |
| W-CDMA Band II | R99 | 22.5 | **23.0** |
| | HSDPA | 21.5 | **22.0** |
| | HSUPA | 21.5 | **22.0** |
| Upper limit (dB): 0.5 ~ -1.5 | | RF Output Power (dBm) | |
| RF Air interface | Mode | Target | Max. tune-up tolerance limit |
| LTE Band 5 | QPSK | 24.0 | **24.5** |
| LTE Band 17 | QPSK | 21.5 | **22.0** |
| Upper limit (dB): 0.5 ~ -1.5 | | RF Output Power (dBm) | |
| RF Air interface | Mode | Target | Max. tune-up tolerance limit |
| WiFi 2.4 GHz | 802.11b | 17.0 | **17.5** |
| | 802.11g | 14.0 | **14.5** |
| | 802.11n HT20 | 12.0 | **12.5** |
| Upper limit (dB): 0.5 ~ -1.5 | | RF Output Power (dBm) | |
| RF Air interface | Mode | Target | Max. tune-up tolerance limit |
| WiFi 5 GHz | 802.11a | 11.0 | **11.5** |
| | 802.11n HT20 | 10.0 | **10.5** |
| | 802.11n HT40 | 10.0 | **10.5** |
| | 802.11ac (80 MHz) | 9.0 | **9.5** |
| Upper limit (dB): 0.5 ~ -1.5 | | RF Output Power (dBm) | |
| RF Air interface | Mode | Target | Max. tune-up tolerance limit |
| Bluetooth | GFSK | 8.0 | **8.5** |
| | DQPSK | 8.0 | **8.5** |
| | 8-DPSK | 8.0 | **8.5** |
| | 4.0 LE | 8.0 | **8.5** |


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## 7.4. Simultaneous Transmission Condition

| RF Exposure Condition | Capable Transmit Configurations |
|---|---|
| Head | 1. GSM1900 Voice + WiFi 2.4/5 GHz<br>2. WCDMA Band V/II + WiFi 2.4/5 GHz<br>3. LTE Band 5/17 + WiFi 2.4/5 GHz |
| Body-worn Accessory | 1. GSM1900 Voice + WiFi 2.4/5 GHz<br>2. GSM1900 Voice + BT<br>3. WCDMA Band V/II + WiFi 2.4/5 GHz<br>4. WCDMA Band V/II + BT<br>5. LTE Band 5/17+ WiFi 2.4/5 GHz<br>6. LTE Band 5/17 + BT |
| Wireless Router (Hotspot) & WiFi Direct | 1. GSM1900 (GPRS/EDGE) + WiFi 2.4/5.8 GHz<br>2. WCDMA Band V/II + WiFi 2.4/5.8 GHz<br>3. LTE Band 5/17 + WiFi 2.4/5.8 GHz |

Notes:
1. WiFi 2.4 GHz and WiFi 5.8 GHz supports Hotspot.
2. WiFi 2.4 GHz and WiFi 5.8 GHz supports WiFi Direct.
3. GPRS and W-CDMA and LTE supports Hotspot.
4. WiFi 2.4 GHz Radio can transmit simultaneously with Bluetooth Radio.
5. WiFi 5 GHz Radio can transmit simultaneously with Bluetooth Radio.


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## 7.5. General LTE SAR Test and Reporting Considerations

<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td rowspan="19">Frequency range, Channel Bandwidth, Numbers and Frequencies</td><td>Band 5</td></tr>
<tr><td>Tx: 824 to 849 MHz | Rx: 869 to 894 MHz</td></tr>
<tr><td>Band 17</td></tr>
<tr><td>Tx: 704 to 716 MHz | Rx: 734 to 746 MHz</td></tr>
<tr><td>
<table>
<tr><th rowspan="2">Band 5</th><th colspan="6">Channel Bandwidth</th></tr>
<tr><th>20 MHz</th><th>15 MHz</th><th>10 MHz</th><th>5 MHz</th><th>3 MHz</th><th>1.4 MHz</th></tr>
<tr><td>Low</td><td></td><td></td><td>20450</td><td>20425</td><td></td><td></td></tr>
<tr><td>Mid</td><td></td><td></td><td>20525</td><td>20525</td><td></td><td></td></tr>
<tr><td>High</td><td></td><td></td><td>20600</td><td>20625</td><td></td><td></td></tr>
<tr><th rowspan="2">Band 17</th><th colspan="6">Channel Bandwidth</th></tr>
<tr><th>20 MHz</th><th>15 MHz</th><th>10 MHz</th><th>5 MHz</th><th>3 MHz</th><th>1.4 MHz</th></tr>
<tr><td>Low</td><td></td><td></td><td>23780</td><td>23755</td><td></td><td></td></tr>
<tr><td>Mid</td><td></td><td></td><td>23790</td><td>23790</td><td></td><td></td></tr>
<tr><td>High</td><td></td><td></td><td>23800</td><td>23825</td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>LTE transmitter and antenna implementation</td><td>LTE has one TX/RX antennas.<br>Refer to Section 17 for antenna locations</td></tr>
<tr><td>Maximum power reduction (MPR)</td><td>
Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3
<table>
<tr><th rowspan="2">Modulation</th><th colspan="6">Channel bandwidth / Transmission bandwidth (RB)</th><th rowspan="2">MPR (dB)</th></tr>
<tr><th>1.4 MHz</th><th>3.0 MHz</th><th>5 MHz</th><th>10 MHz</th><th>15 MHz</th><th>20 MHz</th></tr>
<tr><td>QPSK</td><td>> 5</td><td>> 4</td><td>> 8</td><td>> 12</td><td>> 16</td><td>> 18</td><td>≤ 1</td></tr>
<tr><td>16 QAM</td><td>≤ 5</td><td>≤ 4</td><td>≤ 8</td><td>≤ 12</td><td>≤ 16</td><td>≤ 18</td><td>≤ 1</td></tr>
<tr><td>16 QAM</td><td>> 5</td><td>> 4</td><td>> 8</td><td>> 12</td><td>> 16</td><td>> 18</td><td>≤ 2</td></tr>
</table>
MPR Built-in by design<br>A-MPR (additional MPR) was disabled during SAR testing
</td></tr>
<tr><td>Power reduction</td><td>No</td></tr>
<tr><td>Spectrum plots for RB configurations</td><td>A properly configured basestation simulator was used for the SAR and power measurements; therefore, spectrum plots for each RB allocation and offset configuration are not included in the SAR report.</td></tr>
</table>


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# 8. RF Exposure Conditions

Refer to Section 17 “Antenna Locations 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, LTE and WiFi

| 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

### For WWAN and LTE

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

### For WiFi

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

## 8.3. Hotspot Exposure Conditions

### For WWAN and LTE

| Test Configurations | Antenna-to-edge/surface | SAR Required | Note |
|---|---|---|---|
| Rear | <25 mm | Yes | |
| Front | <25 mm | Yes | |
| Edge 1 (Top) | 119 mm | No | SAR is not required because the distance from the antenna to the edge is > 25 mm as per KDB 941225 D06 Hot Spot SAR v01r01 |
| Edge 2 (Right) | 3 mm | Yes | |
| Edge 3 (Bottom) | 2 mm | Yes | |
| Edge 4 (Left) | 3 mm | Yes | |

## 8.4. Hotspot Exposure Conditions & WiFi Direct

### For WiFi

| Test Configurations | Antenna-to-edge/surface | SAR Required | Note |
|---|---|---|---|
| Rear | <25 mm | Yes | |
| Front | <25 mm | Yes | |
| Edge 1 (Top) | 13 mm | Yes | |
| Edge 2 (Right) | 31 mm | Yes | |
| Edge 3 (Bottom) | 122 mm | No | SAR is not required because the distance from the antenna to the edge is > 25 mm as per KDB 941225 D06 Hot Spot SAR v01r01 |
| Edge 4 (Left) | 29 mm | Yes | |


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# 9. RF Output Power Measurement

## 9.1. GSM

**GSM (GMSK) - Voice Mode**

| Band | Ch No. | Freq. (MHz) | Avg burst Pwr (dBm) |
|---|---|---|---|
| 1900 | 512 | 1850.2 | 30.0 |
| | 661 | 1880.0 | 30.4 |
| | 810 | 1909.8 | 30.1 |

**GPRS (GMSK) - Coding Scheme: CS1**

| Band | Ch No. | Freq. (MHz) | Avg Power (dBm) | | | | Avg Power (dBm) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 time slot | | 2 time slots | | 3 time slots | | 4 time slots | |
| | | | Burst | Frame | Burst | Frame | Burst | Frame | Burst | Frame |
| 1900 | 512 | 1850.2 | 30.1 | 21.0 | 28.6 | 22.6 | **27.8** | **23.6** | 26.1 | 23.0 |
| | 661 | 1880.0 | 30.5 | 21.4 | 29.1 | 23.1 | **28.3** | **24.1** | 26.5 | 23.5 |
| | 810 | 1909.8 | 30.0 | 20.9 | 28.7 | 22.7 | **27.9** | **23.7** | 26.1 | 23.1 |

**EGPRS (8PSK) - Coding Scheme: MCS5**

**This mode is Rx only**

**Notes:**

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

- Head & Body-worn Accessory: GMSK Voice Mode
- Hotspot mode: GMSK (GPRS) mode with 3 time slots, based on the output power measurements above


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## 9.2. W-CDMA

**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 |

**Measured Results**

| Band | Mode | UL Ch No. | Freq. (MHz) | Avg Pwr (dBm) |
|---|---|---|---|---|
| W-CDMA Band V | Rel 99 (RMC, 12.2 kbps) | 4132 | 826.4 | 24.2 |
| | | 4183 | 836.6 | 24.1 |
| | | 4233 | 846.6 | 24.3 |
| W-CDMA Band II | Rel 99 (RMC, 12.2 kbps) | 9262 | 1852.4 | 22.6 |
| | | 9400 | 1880.0 | 22.8 |
| | | 9538 | 1907.6 | 22.7 |


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**HSDPA**

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

| | Mode | HSDPA | HSDPA | HSDPA | HSDPA |
|---|---|---|---|---|---|
| | Subtest | 1 | 2 | 3 | 4 |
| W-CDMA General Settings | Loopback Mode | Test Mode 1 | | | |
| | Rel99 RMC | 12.2kbps RMC | | | |
| | HSDPA FRC | H-Set1 | | | |
| | Power Control Algorithm | Algorithm 2 | | | |
| | βc | 2/15 | 12/15 | 15/15 | 15/15 |
| | βd | 15/15 | 15/15 | 8/15 | 4/15 |
| | Bd (SF) | 64 | | | |
| | βc/βd | 2/15 | 12/15 | 15/8 | 15/4 |
| | βhs | 4/15 | 24/15 | 30/15 | 30/15 |
| | MPR (dB) | 0 | 0 | 0.5 | 0.5 |
| 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 | | | |

**Measured Results**

| Band | Mode | UL Ch No. | Freq. (MHz) | Avg Pwr (dBm) |
|---|---|---|---|---|
| W-CDMA Band V | Subtest 1 | 4132 | 826.4 | 23.1 |
| | | 4183 | 836.6 | 22.9 |
| | | 4233 | 846.6 | 23.0 |
| | Subtest 2 | 4132 | 826.4 | 22.6 |
| | | 4183 | 836.6 | 22.6 |
| | | 4233 | 846.6 | 22.6 |
| | Subtest 3 | 4132 | 826.4 | 22.6 |
| | | 4183 | 836.6 | 22.5 |
| | | 4233 | 846.6 | 22.6 |
| | Subtest 4 | 4132 | 826.4 | 22.5 |
| | | 4183 | 836.6 | 22.4 |
| | | 4233 | 846.6 | 22.6 |
| W-CDMA Band II | Subtest 1 | 9262 | 1852.4 | 21.4 |
| | | 9400 | 1880.0 | 21.5 |
| | | 9538 | 1907.6 | 21.5 |
| | Subtest 2 | 9262 | 1852.4 | 21.1 |
| | | 9400 | 1880.0 | 21.3 |
| | | 9538 | 1907.6 | 21.2 |
| | Subtest 3 | 9262 | 1852.4 | 21.1 |
| | | 9400 | 1880.0 | 21.3 |
| | | 9538 | 1907.6 | 21.1 |
| | Subtest 4 | 9262 | 1852.4 | 21.1 |
| | | 9400 | 1880.0 | 21.2 |
| | | 9538 | 1907.6 | 21.2 |

Maximum output power levels that are possible for all subtests reported.


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**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 | |


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**Measured Results**

| Band | Mode | UL Ch No. | Freq. (MHz) | Avg Pwr (dBm) |
|---|---|---|---|---|
| W-CDMA Band V | Subtest 1 | 4132 | 826.4 | 23.0 |
| | | 4183 | 836.6 | 22.9 |
| | | 4233 | 846.6 | 23.0 |
| | Subtest 2 | 4132 | 826.4 | 23.2 |
| | | 4183 | 836.6 | 23.1 |
| | | 4233 | 846.6 | 23.2 |
| | Subtest 3 | 4132 | 826.4 | 22.5 |
| | | 4183 | 836.6 | 22.4 |
| | | 4233 | 846.6 | 22.5 |
| | Subtest 4 | 4132 | 826.4 | 23.2 |
| | | 4183 | 836.6 | 23.0 |
| | | 4233 | 846.6 | 23.2 |
| | Subtest 5 | 4132 | 826.4 | 22.7 |
| | | 4183 | 836.6 | 22.6 |
| | | 4233 | 846.6 | 22.7 |
| W-CDMA Band II | Subtest 1 | 9262 | 1852.4 | 21.7 |
| | | 9400 | 1880.0 | 21.8 |
| | | 9538 | 1907.6 | 21.7 |
| | Subtest 2 | 9262 | 1852.4 | 21.6 |
| | | 9400 | 1880.0 | 21.7 |
| | | 9538 | 1907.6 | 21.7 |
| | Subtest 3 | 9262 | 1852.4 | 21.4 |
| | | 9400 | 1880.0 | 21.6 |
| | | 9538 | 1907.6 | 21.4 |
| | Subtest 4 | 9262 | 1852.4 | 21.6 |
| | | 9400 | 1880.0 | 21.7 |
| | | 9538 | 1907.6 | 21.7 |
| | Subtest 5 | 9262 | 1852.4 | 21.1 |
| | | 9400 | 1880.0 | 21.3 |
| | | 9538 | 1907.6 | 21.2 |


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## 9.3. LTE Band

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

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

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

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

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

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

| Network Signalling value | Requirements (sub-clause) | E-UTRA Band | Channel bandwidth (MHz) | Resources Blocks ($N_{RB}$) | A-MPR (dB) |
|---|---|---|---|---|---|
| NS_01 | 6.6.2.1.1 | Table 5.5-1 | 1.4, 3, 5, 10, 15, 20 | Table 5.6-1 | NA |
| NS_03 | 6.6.2.2.1 | 2, 4,10, 23, 25, 35, 36 | 3 | >5 | ≤ 1 |
| | | | 5 | >6 | ≤ 1 |
| | | | 10 | >6 | ≤ 1 |
| | | | 15 | >8 | ≤ 1 |
| | | | 20 | >10 | ≤ 1 |
| NS_04 | 6.6.2.2.2 | 41 | 5 | >6 | ≤ 1 |
| | | | 10, 15, 20 | See Table 6.2.4-4 | |
| NS_05 | 6.6.3.3.1 | 1 | 10,15,20 | ≥ 50 | ≤ 1 |
| NS_06 | 6.6.2.2.3 | 12, 13, 14, 17 | 1.4, 3, 5, 10 | Table 5.6-1 | n/a |
| NS_07 | 6.6.2.2.3<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. | | | | | |


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**LTE Band 5 Measured Results**

| Band | BW (MHz) | Mode | RB Allocation | RB offset | Target MPR | Avg Pwr (dBm) | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | 829 MHz | 836.5 MHz | 844 MHz |
| LTE Band 5 | 10 | QPSK | 1 | 0 | 0 | 24.1 | 24.1 | 23.9 |
| | | | 1 | 25 | 0 | 24.1 | 23.8 | 23.8 |
| | | | 1 | 49 | 0 | 24.1 | 23.9 | 23.9 |
| | | | 25 | 0 | 1 | 23.2 | 23.1 | 22.9 |
| | | | 25 | 12 | 1 | 23.2 | 22.9 | 22.8 |
| | | | 25 | 25 | 1 | 23.1 | 22.9 | 22.9 |
| | | | 50 | 0 | 1 | 23.1 | 22.9 | 22.9 |
| | | 16QAM | 1 | 0 | 1 | 22.8 | 22.7 | 22.4 |
| | | | 1 | 25 | 1 | 22.7 | 22.4 | 22.3 |
| | | | 1 | 49 | 1 | 22.7 | 22.5 | 22.5 |
| | | | 25 | 0 | 2 | 22.2 | 22.0 | 21.9 |
| | | | 25 | 12 | 2 | 22.2 | 22.0 | 22.0 |
| | | | 25 | 25 | 2 | 22.1 | 21.8 | 22.0 |
| | | | 50 | 0 | 2 | 22.2 | 22.0 | 22.0 |
| Band | BW (MHz) | Mode | RB Allocation | RB offset | Target MPR | Avg Pwr (dBm) | | |
| | | | | | | 826.5 MHz | 836.5 MHz | 846.5 MHz |
| LTE Band 5 | 5 | QPSK | 1 | 0 | 0 | 24.2 | 23.9 | 23.9 |
| | | | 1 | 12 | 0 | 24.3 | 23.7 | 24.0 |
| | | | 1 | 24 | 0 | 24.1 | 23.8 | 24.0 |
| | | | 12 | 0 | 1 | 23.3 | 22.9 | 23.1 |
| | | | 12 | 6 | 1 | 23.2 | 22.9 | 23.1 |
| | | | 12 | 11 | 1 | 23.2 | 22.9 | 23.0 |
| | | | 25 | 0 | 1 | 23.2 | 22.9 | 22.9 |
| | | 16QAM | 1 | 0 | 1 | 22.7 | 22.4 | 23.3 |
| | | | 1 | 12 | 1 | 22.9 | 22.3 | 23.5 |
| | | | 1 | 24 | 1 | 22.7 | 22.5 | 23.4 |
| | | | 12 | 0 | 2 | 22.4 | 22.0 | 22.0 |
| | | | 12 | 6 | 2 | 22.2 | 22.0 | 22.0 |
| | | | 12 | 11 | 2 | 22.2 | 21.8 | 22.0 |
| | | | 25 | 0 | 2 | 22.4 | 22.0 | 21.8 |


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**LTE Band 17 Measured Results**

| Band | BW (MHz) | Mode | RB Allocation | RB offset | Target MPR | Avg Pwr (dBm) 710 MHz |
|---|---|---|---|---|---|---|
| LTE Band 17 | 10 | QPSK | 1 | 0 | 0 | 21.8 |
| | | | 1 | 25 | 0 | 21.4 |
| | | | 1 | 49 | 0 | 21.4 |
| | | | 25 | 0 | 1 | 21.7 |
| | | | 25 | 12 | 1 | 21.4 |
| | | | 25 | 25 | 1 | 21.4 |
| | | | 50 | 0 | 1 | 21.5 |
| | | 16QAM | 1 | 0 | 1 | 21.4 |
| | | | 1 | 25 | 1 | 21.1 |
| | | | 1 | 49 | 1 | 21.0 |
| | | | 25 | 0 | 2 | 20.7 |
| | | | 25 | 12 | 2 | 20.6 |
| | | | 25 | 25 | 2 | 20.5 |
| | | | 50 | 0 | 2 | 20.5 |
| Band | BW (MHz) | Mode | RB Allocation | RB offset | Target MPR | Avg Pwr (dBm) 710 MHz |
| LTE Band 17 | 5 | QPSK | 1 | 0 | 0 | 21.7 |
| | | | 1 | 12 | 0 | 21.5 |
| | | | 1 | 24 | 0 | 21.3 |
| | | | 12 | 0 | 1 | 21.6 |
| | | | 12 | 6 | 1 | 21.5 |
| | | | 12 | 11 | 1 | 21.4 |
| | | | 25 | 0 | 1 | 21.5 |
| | | 16QAM | 1 | 0 | 1 | 21.2 |
| | | | 1 | 12 | 1 | 21.0 |
| | | | 1 | 24 | 1 | 20.9 |
| | | | 12 | 0 | 2 | 20.6 |
| | | | 12 | 6 | 2 | 20.6 |
| | | | 12 | 11 | 2 | 20.5 |
| | | | 25 | 0 | 2 | 20.5 |

**Note(s):**

10/5 MHz Bandwidths does not support at least three non-overlapping channels in certain channel bandwidths. When a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing per KDB941225 D05 SAR for LTE Devices v02r02


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## 9.4. WiFi (2.4 GHz Band)

Required Test Channels per KDB 248227 D01

| Mode | Band | GHz | Channel | "Default Test Channels" | |
|---|---|---|---|---|---|
| | | | | 802.11b | 802.11g |
| 802.11b/g | 2.4 GHz | **2.412** | 1# | √ | ∇ |
| | | **2.437** | 6 | √ | ∇ |
| | | **2.462** | 11# | √ | ∇ |

**Notes:**
√ = "default test channels"
∇ = possible 802.11g channels with maximum average output ¼ dB ≥ the "default test channels"
# = when output power is reduced for channel 1 and /or 11 to meet restricted band requirements the highest output channels closest to each of these channels should be tested.

**Measured Results**

| Band (GHz) | Mode | Ch # | Freq. (MHz) | Avg Pwr (dBm) |
|---|---|---|---|---|
| 2.4 (DTS) | 802.11b | 1 | 2412 | 16.7 |
| | | 6 | 2437 | 16.8 |
| | | 11 | 2462 | 16.8 |
| | 802.11g | 1 | 2412 | 14.4 |
| | | 6 | 2437 | 14.1 |
| | | 11 | 2462 | 13.6 |
| | 802.11n (HT20) | 1 | 2412 | 12.4 |
| | | 6 | 2437 | 12.4 |
| | | 11 | 2462 | 11.5 |

**Note(s):**

Per KDB 248227 D01, SAR is not required for 802.11g/HT20/HT40 channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11b channels.


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## 9.5. WiFi (5 GHz Bands)

**Required Test Channels per KDB 248227 D01**

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

√ = "default test channels"

* = possible 802.11a channels with maximum average output > the "default test channels"

# = when output power is reduced for channel 1 and /or 11 to meet restricted band requirements the highest output channels closest to each of these channels should be tested.


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**Measured Results**

| Band (GHz) | Mode | Ch # | Freq. (MHz) | Avg Pwr (dBm) |
|---|---|---|---|---|
| 5.2 (UNII) | 802.11a | 36 | 5180 | 11.2 |
| | | 40 | 5200 | 11.2 |
| | | 44 | 5220 | 11.2 |
| | | 48 | 5240 | 11.2 |
| | 802.11n (HT20) | 36 | 5180 | 10.4 |
| | | 40 | 5200 | 10.4 |
| | | 48 | 5240 | 10.4 |
| | 802.11n (HT40) | 38 | 5190 | 10.1 |
| | | 46 | 5230 | 10.1 |
| | 802.11ac (HT80) | 42 | 5210 | 8.5 |
| 5.3 (UNII) | 802.11a | 52 | 5260 | 10.9 |
| | | 56 | 5280 | 10.9 |
| | | 60 | 5300 | 10.9 |
| | | 64 | 5320 | 10.9 |
| | 802.11n (HT20) | 52 | 5260 | 9.9 |
| | | 60 | 5300 | 9.8 |
| | | 64 | 5320 | 9.8 |
| | 802.11n (HT40) | 54 | 5270 | 10.1 |
| | | 62 | 5310 | 10.0 |
| | 802.11ac (HT80) | 58 | 5290 | 8.6 |
| 5.5 (UNII) | 802.11a | 100 | 5500 | 11.1 |
| | | 104 | 5520 | 11.1 |
| | | 108 | 5540 | 11.0 |
| | | 112 | 5560 | 11.0 |
| | | 116 | 5580 | 10.9 |
| | | 120 | 5600 | 10.9 |
| | | 124 | 5620 | 10.8 |
| | | 128 | 5640 | 10.8 |
| | | 132 | 5660 | 10.7 |
| | | 136 | 5680 | 10.7 |
| | | 140 | 5700 | 10.6 |
| | 802.11n (HT20) | 100 | 5500 | 10.2 |
| | | 116 | 5580 | 9.9 |
| | | 140 | 5700 | 9.7 |
| | 802.11n (HT40) | 102 | 5510 | 10.4 |
| | | 110 | 5550 | 10.4 |
| | | 134 | 5670 | 10.0 |
| | 802.11ac (HT80) | 106 | 5530 | 9.0 |
| | | 122 | 5610 | 8.9 |
| | | 138 | 5690 | 8.6 |
| 5.8 (DTS) | 802.11a | 149 | 5745 | 11.2 |
| | | 153 | 5765 | 11.2 |
| | | 157 | 5785 | 11.2 |
| | | 161 | 5805 | 11.1 |
| | | 165 | 5825 | 11.1 |
| | 802.11n (HT20) | 149 | 5745 | 10.3 |
| | | 157 | 5785 | 10.3 |
| | | 161 | 5805 | 10.3 |
| | 802.11n (HT40) | 151 | 5755 | 10.0 |
| | | 159 | 5795 | 10.0 |
| | 802.11ac (HT80) | 155 | 5775 | 8.9 |


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## 9.6. Bluetooth

| Band (GHz) | Mode | Ch # | Freq. (MHz) | Conducted Avg Power | |
|---|---|---|---|---|---|
| | | | | (dBm) | (mW) |
| 2.4 | V3.0 + EDR, GFSK | 0 | 2402 | 7.3 | 5.37 |
| | | 39 | 2441 | 8.4 | 6.92 |
| | | 78 | 2480 | 6.9 | 4.90 |
| | V3.0 + EDR, π/4 DQPSK | 0 | 2402 | 4.1 | 2.57 |
| | | 39 | 2441 | 5.3 | 3.39 |
| | | 78 | 2480 | 3.2 | 2.09 |
| | V3.0 + EDR, 8-DPSK | 0 | 2402 | 4.3 | 2.69 |
| | | 39 | 2441 | 5.6 | 3.63 |
| | | 78 | 2480 | 3.5 | 2.24 |
| | V4.0 LE, GFSK | 0 | 2402 | 2.1 | 1.61 |
| | | 19 | 2440 | 3.8 | 2.42 |
| | | 39 | 2480 | 1.9 | 1.55 |


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# 10. Tissue Dielectric Properties

## IEEE Std 1528-2003 Table 2

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

## FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r01

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


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## 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 |


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## 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.

**SAR Room 1**

| | Freq. (MHz) | Liquid Parameters | | | Measured | Target | Delta (%) | Limit ±(%) |
|---|---|---|---|---|---|---|---|---|
| 8/5/2013 | Body 2450 | e' | 50.8800 | Relative Permittivity ($\varepsilon_r$): | 50.88 | 52.70 | -3.45 | 5 |
| | | e'' | 14.1900 | Conductivity (σ): | 1.93 | 1.95 | -0.87 | 5 |
| | Body 2410 | e' | 51.0000 | Relative Permittivity ($\varepsilon_r$): | 51.00 | 52.76 | -3.33 | 5 |
| | | e'' | 14.0500 | Conductivity (σ): | 1.88 | 1.91 | -1.30 | 5 |
| | Body 2475 | e' | 50.8100 | Relative Permittivity ($\varepsilon_r$): | 50.81 | 52.67 | -3.53 | 5 |
| | | e'' | 14.2900 | Conductivity (σ): | 1.97 | 1.99 | -0.94 | 5 |
| 8/6/2013 | Head 2450 | e' | 37.8900 | Relative Permittivity ($\varepsilon_r$): | 37.89 | 39.20 | -3.34 | 5 |
| | | e'' | 13.4700 | Conductivity (σ): | 1.83 | 1.80 | 1.94 | 5 |
| | Head 2410 | e' | 38.0600 | Relative Permittivity ($\varepsilon_r$): | 38.06 | 39.28 | -3.10 | 5 |
| | | e'' | 13.3700 | Conductivity (σ): | 1.79 | 1.76 | 1.77 | 5 |
| | Head 2475 | e' | 37.8000 | Relative Permittivity ($\varepsilon_r$): | 37.80 | 39.17 | -3.49 | 5 |
| | | e'' | 13.5300 | Conductivity (σ): | 1.86 | 1.83 | 1.91 | 5 |
| 8/13/2013 | Head 750 | e' | 42.3100 | Relative Permittivity ($\varepsilon_r$): | 42.31 | 41.96 | 0.83 | 5 |
| | | e'' | 21.5500 | Conductivity (σ): | 0.90 | 0.89 | 0.63 | 5 |
| | Head 700 | e' | 42.9100 | Relative Permittivity ($\varepsilon_r$): | 42.91 | 42.22 | 1.64 | 5 |
| | | e'' | 21.9600 | Conductivity (σ): | 0.85 | 0.89 | -3.88 | 5 |
| | Head 790 | e' | 41.8100 | Relative Permittivity ($\varepsilon_r$): | 41.81 | 41.76 | 0.13 | 5 |
| | | e'' | 21.2000 | Conductivity (σ): | 0.93 | 0.90 | 3.92 | 5 |
| 8/13/2013 | Body 750 | e' | 53.3000 | Relative Permittivity ($\varepsilon_r$): | 53.30 | 55.55 | -4.04 | 5 |
| | | e'' | 23.1400 | Conductivity (σ): | 0.96 | 0.96 | 0.20 | 5 |
| | Body 700 | e' | 53.8800 | Relative Permittivity ($\varepsilon_r$): | 53.88 | 55.74 | -3.33 | 5 |
| | | e'' | 23.5500 | Conductivity (σ): | 0.92 | 0.96 | -4.44 | 5 |
| | Body 790 | e' | 52.8600 | Relative Permittivity ($\varepsilon_r$): | 52.86 | 55.39 | -4.57 | 5 |
| | | e'' | 22.8500 | Conductivity (σ): | 1.00 | 0.97 | 3.89 | 5 |
| 8/15/2013 | Body 5180 | e' | 47.8900 | Relative Permittivity ($\varepsilon_r$): | 47.89 | 49.05 | -2.36 | 5 |
| | | e'' | 18.0000 | Conductivity (σ): | 5.18 | 5.27 | -1.65 | 5 |
| | Body 5200 | e' | 47.9300 | Relative Permittivity ($\varepsilon_r$): | 47.93 | 49.02 | -2.22 | 5 |
| | | e'' | 18.1700 | Conductivity (σ): | 5.25 | 5.29 | -0.78 | 5 |
| | Body 5600 | e' | 47.2300 | Relative Permittivity ($\varepsilon_r$): | 47.23 | 48.48 | -2.57 | 5 |
| | | e'' | 18.5100 | Conductivity (σ): | 5.76 | 5.76 | 0.04 | 5 |
| | Body 5800 | e' | 46.6200 | Relative Permittivity ($\varepsilon_r$): | 46.62 | 48.20 | -3.28 | 5 |
| | | e'' | 18.5600 | Conductivity (σ): | 5.99 | 6.00 | -0.24 | 5 |
| | Body 5825 | e' | 46.7000 | Relative Permittivity ($\varepsilon_r$): | 46.70 | 48.20 | -3.11 | 5 |
| | | e'' | 18.7700 | Conductivity (σ): | 6.08 | 6.00 | 1.32 | 5 |


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**Tissue Dielectric Parameter Check Results (continued)**

| | Freq. (MHz) | Liquid Parameters | | | Measured | Target | Delta (%) | Limit ±(%) |
|---|---|---|---|---|---|---|---|---|
| 8/16/2013 | Head 5180 | e' | 37.2500 | Relative Permittivity ($\varepsilon_r$): | 37.25 | 36.01 | 3.43 | 5 |
| | | e'' | 15.5000 | Conductivity (σ): | 4.46 | 4.63 | -3.59 | 5 |
| | Head 5200 | e' | 37.2600 | Relative Permittivity ($\varepsilon_r$): | 37.26 | 35.99 | 3.53 | 5 |
| | | e'' | 15.5400 | Conductivity (σ): | 4.49 | 4.65 | -3.39 | 5 |
| | Head 5600 | e' | 36.7600 | Relative Permittivity ($\varepsilon_r$): | 36.76 | 35.53 | 3.45 | 5 |
| | | e'' | 15.7600 | Conductivity (σ): | 4.91 | 5.06 | -3.02 | 5 |
| | Head 5800 | e' | 36.4500 | Relative Permittivity ($\varepsilon_r$): | 36.45 | 35.30 | 3.26 | 5 |
| | | e'' | 15.8400 | Conductivity (σ): | 5.11 | 5.27 | -3.07 | 5 |
| | Head 5825 | e' | 36.4200 | Relative Permittivity ($\varepsilon_r$): | 36.42 | 35.30 | 3.17 | 5 |
| | | e'' | 15.8900 | Conductivity (σ): | 5.15 | 5.27 | -2.34 | 5 |

**SAR Room 2**

| | Freq. (MHz) | Liquid Parameters | | | Measured | Target | Delta (%) | Limit ±(%) |
|---|---|---|---|---|---|---|---|---|
| 8/7/2013 | Head 1900 | e' | 39.1400 | Relative Permittivity ($\varepsilon_r$): | 39.14 | 40.00 | -2.15 | 5 |
| | | e'' | 13.3200 | Conductivity (σ): | 1.41 | 1.40 | 0.51 | 5 |
| | Head 1850 | e' | 39.3500 | Relative Permittivity ($\varepsilon_r$): | 39.35 | 40.00 | -1.63 | 5 |
| | | e'' | 13.2500 | Conductivity (σ): | 1.36 | 1.40 | -2.64 | 5 |
| | Head 1910 | e' | 39.1000 | Relative Permittivity ($\varepsilon_r$): | 39.10 | 40.00 | -2.25 | 5 |
| | | e'' | 13.3600 | Conductivity (σ): | 1.42 | 1.40 | 1.35 | 5 |
| 8/7/2013 | Body 1900 | e' | 51.2700 | Relative Permittivity ($\varepsilon_r$): | 51.27 | 53.30 | -3.81 | 5 |
| | | e'' | 14.4300 | Conductivity (σ): | 1.52 | 1.52 | 0.29 | 5 |
| | Body 1850 | e' | 51.4900 | Relative Permittivity ($\varepsilon_r$): | 51.49 | 53.30 | -3.40 | 5 |
| | | e'' | 14.3200 | Conductivity (σ): | 1.47 | 1.52 | -3.09 | 5 |
| | Body 1910 | e' | 51.2400 | Relative Permittivity ($\varepsilon_r$): | 51.24 | 53.30 | -3.86 | 5 |
| | | e'' | 14.4600 | Conductivity (σ): | 1.54 | 1.52 | 1.03 | 5 |
| 8/9/2013 | Body 835 | e' | 53.1400 | Relative Permittivity ($\varepsilon_r$): | 53.14 | 55.20 | -3.73 | 5 |
| | | e'' | 21.7000 | Conductivity (σ): | 1.01 | 0.97 | 3.87 | 5 |
| | Body 820 | e' | 53.2500 | Relative Permittivity ($\varepsilon_r$): | 53.25 | 55.28 | -3.67 | 5 |
| | | e'' | 21.7900 | Conductivity (σ): | 0.99 | 0.97 | 2.59 | 5 |
| | Body 850 | e' | 53.0700 | Relative Permittivity ($\varepsilon_r$): | 53.07 | 55.16 | -3.78 | 5 |
| | | e'' | 21.6500 | Conductivity (σ): | 1.02 | 0.99 | 3.66 | 5 |
| 8/9/2013 | Head 835 | e' | 41.3300 | Relative Permittivity ($\varepsilon_r$): | 41.33 | 41.50 | -0.41 | 5 |
| | | e'' | 19.5500 | Conductivity (σ): | 0.91 | 0.90 | 0.85 | 5 |
| | Head 820 | e' | 41.4800 | Relative Permittivity ($\varepsilon_r$): | 41.48 | 41.60 | -0.29 | 5 |
| | | e'' | 19.5900 | Conductivity (σ): | 0.89 | 0.90 | -0.59 | 5 |
| | Head 850 | e' | 41.2000 | Relative Permittivity ($\varepsilon_r$): | 41.20 | 41.50 | -0.72 | 5 |
| | | e'' | 19.4900 | Conductivity (σ): | 0.92 | 0.92 | 0.67 | 5 |
| 8/25/2013 | Body 5180 | e' | 48.5500 | Relative Permittivity ($\varepsilon_r$): | 48.55 | 49.05 | -1.01 | 5 |
| | | e'' | 18.2700 | Conductivity (σ): | 5.26 | 5.27 | -0.17 | 5 |
| | Body 5200 | e' | 48.4400 | Relative Permittivity ($\varepsilon_r$): | 48.44 | 49.02 | -1.18 | 5 |
| | | e'' | 18.2800 | Conductivity (σ): | 5.29 | 5.29 | -0.18 | 5 |
| | Body 5600 | e' | 47.7500 | Relative Permittivity ($\varepsilon_r$): | 47.75 | 48.48 | -1.50 | 5 |
| | | e'' | 18.6900 | Conductivity (σ): | 5.82 | 5.76 | 1.02 | 5 |
| | Body 5800 | e' | 47.4100 | Relative Permittivity ($\varepsilon_r$): | 47.41 | 48.20 | -1.64 | 5 |
| | | e'' | 19.0300 | Conductivity (σ): | 6.14 | 6.00 | 2.29 | 5 |
| | Body 5825 | e' | 47.4100 | Relative Permittivity ($\varepsilon_r$): | 47.41 | 48.20 | -1.64 | 5 |
| | | e'' | 18.9400 | Conductivity (σ): | 6.13 | 6.00 | 2.24 | 5 |


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**Tissue Dielectric Parameter Check Results (continued)**

**SAR Room 3**

| | Freq. (MHz) | Liquid Parameters | | | Measured | Target | Delta (%) | Limit ±(%) |
|---|---|---|---|---|---|---|---|---|
| 8/23/2013 | Head 5180 | e' | 36.7700 | Relative Permittivity ($\varepsilon_r$): | 36.77 | 36.01 | 2.10 | 5 |
| | | e'' | 15.3900 | Conductivity (σ): | 4.43 | 4.63 | -4.27 | 5 |
| | Head 5200 | e' | 36.7400 | Relative Permittivity ($\varepsilon_r$): | 36.74 | 35.99 | 2.08 | 5 |
| | | e'' | 15.4000 | Conductivity (σ): | 4.45 | 4.65 | -4.26 | 5 |
| | Head 5600 | e' | 36.2700 | Relative Permittivity ($\varepsilon_r$): | 36.27 | 35.53 | 2.07 | 5 |
| | | e'' | 15.6100 | Conductivity (σ): | 4.86 | 5.06 | -3.95 | 5 |
| | Head 5800 | e' | 35.9800 | Relative Permittivity ($\varepsilon_r$): | 35.98 | 35.30 | 1.93 | 5 |
| | | e'' | 15.7300 | Conductivity (σ): | 5.07 | 5.27 | -3.74 | 5 |
| | Head 5825 | e' | 35.9400 | Relative Permittivity ($\varepsilon_r$): | 35.94 | 35.30 | 1.81 | 5 |
| | | e'' | 15.7300 | Conductivity (σ): | 5.09 | 5.27 | -3.33 | 5 |


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# 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 |
| D750V3 | 1019 | 3/5/2013 | 750 | 1g | 8.5 | 8.68 |
| | | | | 10g | 5.59 | 5.75 |
| D835V2 | 4d002 | 10/24/2012 | 835 | 1g | 9.58 | 9.48 |
| | | | | 10g | 6.28 | 6.26 |
| D1900V2 | 5d043 | 11/6/2012 | 1900 | 1g | 39.9 | 40.9 |
| | | | | 10g | 20.9 | 21.6 |
| D2450V2 | 899 | 10/5/2012 | 2450 | 1g | 53.6 | 51.7 |
| | | | | 10g | 25 | 24.3 |
| D5GHzV2 | 1138 | 10/9/2012 | 5200 | 1g | 79.5 | 73.2 |
| | | | | 10g | 22.8 | 20.4 |
| | | | 5500 | 1g | 83.6 | 77.9 |
| | | | | 10g | 23.8 | 21.7 |
| | | | 5600 | 1g | 83.6 | 77.9 |
| | | | | 10g | 23.8 | 21.7 |
| | | | 5800 | 1g | 78.7 | 78.2 |
| | | | | 10g | 22.4 | 20.1 |


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## 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.

**SAR Room 1**

| Date Tested | System Dipole | | T.S. Liquid | | Measured Results | | | Target (Ref. Value) | Delta ±10 % | Est./Zoom Ratio | Plot No. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Type | Serial # | | | Area Scan | Zoom Scan | Normalize to 1 W | | | | |
| 8/5/2013 | D2450V2 | 899 | Body | 1g | 5.42 | 5.48 | 54.80 | 51.70 | 6.00 | -1.11 | 1,2 |
| | | | | 10g | 2.36 | 2.54 | 25.40 | 24.30 | 4.53 | | |
| 8/6/2013 | D2450V2 | 899 | Head | 1g | 5.69 | 5.63 | 56.30 | 53.60 | 5.04 | 1.05 | |
| | | | | 10g | 2.48 | 2.57 | 25.70 | 25.00 | 2.80 | | |
| 8/13/2013 | D750V3 | 1019 | Head | 1g | 0.81 | 0.79 | 7.91 | 8.50 | -6.94 | 1.86 | 3,4 |
| | | | | 10g | 0.55 | 0.52 | 5.15 | 5.59 | -7.87 | | |
| 8/13/2013 | D750V3 | 1019 | Body | 1g | 0.85 | 0.84 | 8.40 | 8.68 | -3.23 | 0.71 | |
| | | | | 10g | 0.58 | 0.56 | 5.59 | 5.75 | -2.78 | | |
| 8/15/2013 | D5GHZV2 (5.2) | 1138 | Body | 1g | 7.15 | 7.73 | 77.30 | 73.20 | 5.60 | -8.11 | |
| | | | | 10g | 2.03 | 2.21 | 22.10 | 20.40 | 8.33 | | |
| 8/15/2013 | D5GHZV2 (5.5) | 1138 | Body | 1g | 7.41 | 8.19 | 81.90 | 77.90 | 5.13 | -10.53 | |
| | | | | 10g | 2.10 | 2.33 | 23.30 | 21.70 | 7.37 | | |
| 8/15/2013 | D5GHZV2 (5.6) | 1138 | Body | 1g | 7.80 | 8.42 | 84.20 | 77.90 | 8.09 | -7.95 | 5,6 |
| | | | | 10g | 2.16 | 2.36 | 23.60 | 21.70 | 8.76 | | |
| 8/15/2013 | D5GHZV2 (5.8) | 1138 | Body | 1g | 6.65 | 7.32 | 73.20 | 78.20 | -6.39 | -10.08 | |
| | | | | 10g | 1.85 | 2.05 | 20.50 | 20.10 | 1.99 | | |
| 8/16/2013 | D5GHZV2 (5.2) | 1138 | Head | 1g | 8.00 | 8.53 | 85.30 | 79.50 | 7.30 | -6.62 | 7,8 |
| | | | | 10g | 2.26 | 2.46 | 24.60 | 22.80 | 7.89 | | |
| 8/16/2013 | D5GHZV2 (5.5) | 1138 | Head | 1g | 8.25 | 8.85 | 88.50 | 83.60 | 5.86 | -7.27 | 9,10 |
| | | | | 10g | 2.27 | 2.51 | 25.10 | 23.80 | 5.46 | | |
| 8/16/2013 | D5GHZV2 (5.6) | 1138 | Head | 1g | 8.15 | 8.84 | 88.40 | 83.60 | 5.74 | -8.47 | |
| | | | | 10g | 2.27 | 2.53 | 25.30 | 23.80 | 6.30 | | |
| 8/16/2013 | D5GHZV2 (5.8) | 1138 | Head | 1g | 7.83 | 8.54 | 85.40 | 78.70 | 8.51 | -9.07 | 11,12 |
| | | | | 10g | 2.17 | 2.44 | 24.40 | 22.40 | 8.93 | | |


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**SAR Room 2**

| Date Tested | System Dipole | | T.S. Liquid | | Measured Results | | | Target (Ref. Value) | Delta ±10 % | Est./Zoom Ratio | Plot No. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Type | Serial # | | | Area Scan | Zoom Scan | Normalize to 1 W | | | | |
| 8/7/2013 | D1900V2 | 5d043 | Head | 1g | 4.11 | 4.02 | 40.20 | 39.90 | 0.75 | 2.19 | |
| | | | | 10g | 2.11 | 2.08 | 20.80 | 20.90 | -0.48 | | |
| 8/7/2013 | D1900V2 | 5d043 | Body | 1g | 4.13 | 4.19 | 41.90 | 40.90 | 2.44 | -1.45 | 13,14 |
| | | | | 10g | 2.13 | 2.17 | 21.70 | 21.60 | 0.46 | | |
| 8/9/2013 | D835V2 | 4d002 | Body | 1g | 1.02 | 1.01 | 10.10 | 9.48 | 6.54 | 0.98 | 15,16 |
| | | | | 10g | 0.68 | 0.66 | 6.62 | 6.26 | 5.75 | | |
| 8/9/2013 | D835V2 | 4d002 | Head | 1g | 1.00 | 0.98 | 9.78 | 9.58 | 2.09 | 2.20 | |
| | | | | 10g | 0.67 | 0.64 | 6.41 | 6.28 | 2.07 | | |
| 8/14/2013 | D835V2 | 4d002 | Head | 1g | 0.99 | 0.95 | 9.50 | 9.58 | -0.84 | 3.75 | |
| | | | | 10g | 0.66 | 0.62 | 6.23 | 6.28 | -0.80 | | |
| 8/25/2013 | D5GHZV2 (5.2) | 1138 | Body | 1g | 6.95 | 7.31 | 73.10 | 73.20 | -0.14 | -5.18 | 17,18 |
| | | | | 10g | 1.93 | 2.07 | 20.70 | 20.40 | 1.47 | | |
| 8/25/2013 | D5GHZV2 (5.5) | 1138 | Body | 1g | 7.44 | 8.06 | 80.60 | 77.90 | 3.47 | -8.33 | 19,20 |
| | | | | 10g | 2.05 | 2.28 | 22.80 | 21.70 | 5.07 | | |
| 8/25/2013 | D5GHZV2 (5.6) | 1138 | Body | 1g | 7.34 | 8.00 | 80.00 | 77.90 | 2.70 | -8.99 | 21,22 |
| | | | | 10g | 2.02 | 2.25 | 22.50 | 21.70 | 3.69 | | |
| 8/25/2013 | D5GHZV2 (5.8) | 1138 | Body | 1g | 6.34 | 7.04 | 70.40 | 72.80 | -3.30 | -11.04 | 23,24 |
| | | | | 10g | 1.76 | 1.99 | 19.90 | 20.10 | -1.00 | | |

**SAR Room 3**

| Date Tested | System Dipole | | T.S. Liquid | | Measured Results | | | Target (Ref. Value) | Delta ±10 % | Est./Zoom Ratio | Plot No. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Type | Serial # | | | Area Scan | Zoom Scan | Normalize to 1 W | | | | |
| 8/23/2013 | D5GHzV2 (5.2) | 1138 | Head | 1g | 7.27 | 7.65 | 76.50 | 79.50 | -3.77 | -5.23 | 25,26 |
| | | | | 10g | 2.00 | 2.19 | 21.90 | 22.80 | -3.95 | | |
| 8/23/2013 | D5GHzV2 (5.5) | 1138 | Head | 1g | 7.37 | 7.80 | 78.00 | 83.60 | -6.70 | -5.83 | 27,28 |
| | | | | 10g | 2.00 | 2.21 | 22.10 | 23.80 | -7.14 | | |
| 8/23/2013 | D5GHzV2 (5.6) | 1138 | Head | 1g | 7.89 | 8.39 | 83.90 | 83.60 | 0.36 | -6.34 | 29,30 |
| | | | | 10g | 2.14 | 2.38 | 23.80 | 23.80 | 0.00 | | |
| 8/23/2013 | D5GHzV2 (5.8) | 1138 | Head | 1g | 7.48 | 7.96 | 79.60 | 78.70 | 1.14 | -6.42 | 31,32 |
| | | | | 10g | 2.02 | 2.24 | 22.40 | 22.40 | 0.00 | | |


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# SAR Test Results

## 11.1. GSM1900

| RF Exposure Conditions | Test Position | Mode | Dist. (mm) | Ch #. | Freq. (MHz) | Power (dBm) | | 1-g SAR (W/kg) | | Plot No. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Tune-up limit | Meas. | Meas. | Scaled | |
| Head | Left Touch | Voice | N/A | 661 | 1880.0 | 30.5 | 30.4 | 0.122 | 0.125 | 1 |
| Head | Left Tilt | Voice | N/A | 661 | 1880.0 | 30.5 | 30.4 | 0.019 | 0.020 | |
| Head | Right Touch | Voice | N/A | 661 | 1880.0 | 30.5 | 30.4 | 0.082 | 0.084 | |
| Head | Right Tilt | Voice | N/A | 661 | 1880.0 | 30.5 | 30.4 | 0.031 | 0.031 | |
| Body & Hotspot | Rear | Voice | 10 | 661 | 1880.0 | 30.5 | 30.4 | 0.269 | 0.275 | 2 |
| Body & Hotspot | Front | Voice | 10 | 661 | 1880.0 | 30.5 | 30.4 | 0.205 | 0.210 | |
| Hotspot | Rear | GPRS 3 Slots | 10 | 661 | 1880.0 | 28.5 | 28.3 | 0.479 | **0.502** | 3 |
| Hotspot | Front | GPRS 3 Slots | 10 | 661 | 1880.0 | 28.5 | 28.3 | 0.373 | 0.391 | |
| Hotspot | Edge 2 | GPRS 3 Slots | 10 | 661 | 1880.0 | 28.5 | 28.3 | 0.047 | 0.050 | |
| Hotspot | Edge 3 | GPRS 3 Slots | 10 | 661 | 1880.0 | 28.5 | 28.3 | 0.353 | 0.370 | |
| Hotspot | Edge 4 | GPRS 3 Slots | 10 | 661 | 1880.0 | 28.5 | 28.3 | 0.210 | 0.220 | |

**Note(s):**

1. 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
   - ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
   - ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz
2. With headset attached. According to KDB 648474 Section 2.3, when the reported SAR for body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.

## 11.2. W-CDMA Band V

| RF Exposure Conditions | Test Position | Mode | Dist. (mm) | Ch #. | Freq. (MHz) | Power (dBm) | | 1-g SAR (W/kg) | | Plot No. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Tune-up limit | Meas. | Meas. | Scaled | |
| Head | Left Touch | Rel 99 RMC | N/A | 4183 | 836.6 | 24.5 | 24.1 | 0.101 | 0.111 | 4 |
| Head | Left Tilt | Rel 99 RMC | N/A | 4183 | 836.6 | 24.5 | 24.1 | 0.058 | 0.064 | |
| Head | Right Touch | Rel 99 RMC | N/A | 4183 | 836.6 | 24.5 | 24.1 | 0.086 | 0.094 | |
| Head | Right Tilt | Rel 99 RMC | N/A | 4183 | 836.6 | 24.5 | 24.1 | 0.055 | 0.060 | |
| Body & Hotspot | Rear | Rel 99 RMC | 10 | 4183 | 836.6 | 24.5 | 24.1 | 0.134 | 0.147 | 5 |
| Body & Hotspot | Front | Rel 99 RMC | 10 | 4183 | 836.6 | 24.5 | 24.1 | 0.092 | 0.101 | |
| Hotspot | Edge 2 | Rel 99 RMC | 10 | 4183 | 836.6 | 24.5 | 24.1 | 0.057 | 0.062 | |
| Hotspot | Edge 3 | Rel 99 RMC | 10 | 4183 | 836.6 | 24.5 | 24.1 | 0.058 | 0.064 | |
| Hotspot | Edge 4 | Rel 99 RMC | 10 | 4183 | 836.6 | 24.5 | 24.1 | 0.088 | 0.096 | |

**Note(s):**

1. 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
   - ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
   - ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz
2. With headset attached. According to KDB 648474 Section 2.3, when the reported SAR for body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.


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## 11.3. W-CDMA Band II

| RF Exposure Conditions | Test Position | Mode | Dist. (mm) | Ch #. | Freq. (MHz) | Power (dBm) | | 1-g SAR (W/kg) | | Plot No. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Tune-up limit | Meas. | Meas. | Scaled | |
| Head | Left Touch | Rel 99 RMC | N/A | 9400 | 1880.0 | 23.0 | 22.8 | 0.145 | **0.152** | 6 |
| Head | Left Tilt | Rel 99 RMC | N/A | 9400 | 1880.0 | 23.0 | 22.8 | 0.0192 | 0.020 | |
| Head | Right Touch | Rel 99 RMC | N/A | 9400 | 1880.0 | 23.0 | 22.8 | 0.142 | 0.149 | |
| Head | Right Tilt | Rel 99 RMC | N/A | 9400 | 1880.0 | 23.0 | 22.8 | 0.042 | 0.044 | |
| Body & Hotspot | Rear | Rel 99 RMC | 10 | 9400 | 1880.0 | 23.0 | 22.8 | 0.470 | **0.492** | 7 |
| Body & Hotspot | Front | Rel 99 RMC | 10 | 9400 | 1880.0 | 23.0 | 22.8 | 0.344 | 0.360 | |
| Hotspot | Edge 2 | Rel 99 RMC | 10 | 9400 | 1880.0 | 23.0 | 22.8 | 0.050 | 0.053 | |
| Hotspot | Edge 3 | Rel 99 RMC | 10 | 9400 | 1880.0 | 23.0 | 22.8 | 0.366 | 0.383 | |
| Hotspot | Edge 4 | Rel 99 RMC | 10 | 9400 | 1880.0 | 23.0 | 22.8 | 0.195 | 0.204 | |

**Note(s):**

1. 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
   - ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
   - ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz
2. With headset attached. According to KDB 648474 Section 2.3, when the reported SAR for body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.


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## 11.4. LTE Band 5

| RF Exposure Conditions | Test Position | Mode | Dist. (mm) | Ch #. | Freq. (MHz) | RB Allocation | RB Offset | Power (dBm) | | 1-g SAR (W/kg) | | Plot No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Tune-up limit | Meas. | Meas. | Scaled | |
| Head | Left Touch | QPSK | N/A | 20450 | 829.0 | 1 | 0 | 24.5 | 24.1 | 0.066 | 0.072 | 8 |
| | | | | 20450 | 829.0 | 25 | 0 | 23.5 | 23.2 | 0.043 | 0.046 | |
| Head | Left Tilt | QPSK | N/A | 20450 | 829.0 | 1 | 0 | 24.5 | 24.1 | 0.056 | 0.061 | |
| | | | | 20450 | 829.0 | 25 | 0 | 23.5 | 23.2 | 0.036 | 0.039 | |
| Head | Right Touch | QPSK | N/A | 20450 | 829.0 | 1 | 0 | 24.5 | 24.1 | 0.063 | 0.069 | |
| | | | | 20450 | 829.0 | 25 | 0 | 23.5 | 23.2 | 0.050 | 0.054 | |
| Head | Right Tilt | QPSK | N/A | 20450 | 829.0 | 1 | 0 | 24.5 | 24.1 | 0.049 | 0.054 | |
| | | | | 20450 | 829.0 | 25 | 0 | 23.5 | 23.2 | 0.039 | 0.042 | |
| Body & Hotspot | Rear | QPSK | 10 | 20450 | 829.0 | 1 | 0 | 24.5 | 24.1 | 0.122 | 0.134 | 9 |
| | | | | 20450 | 829.0 | 25 | 0 | 23.5 | 23.2 | 0.097 | 0.104 | |
| Body & Hotspot | Front | QPSK | 10 | 20450 | 829.0 | 1 | 0 | 24.5 | 24.1 | 0.097 | 0.106 | |
| | | | | 20450 | 829.0 | 25 | 0 | 23.5 | 23.2 | 0.078 | 0.084 | |
| Hotspot | Edge 2 | QPSK | 10 | 20450 | 829.0 | 1 | 0 | 24.5 | 24.1 | 0.069 | 0.076 | |
| | | | | 20450 | 829.0 | 25 | 0 | 23.5 | 23.2 | 0.056 | 0.060 | |
| Hotspot | Edge 3 | QPSK | 10 | 20450 | 829.0 | 1 | 0 | 24.5 | 24.1 | 0.048 | 0.053 | |
| | | | | 20450 | 829.0 | 25 | 0 | 23.5 | 23.2 | 0.039 | 0.042 | |
| Hotspot | Edge 4 | QPSK | 10 | 20450 | 829.0 | 1 | 0 | 24.5 | 24.1 | 0.093 | 0.102 | |
| | | | | 20450 | 829.0 | 25 | 0 | 23.5 | 23.2 | 0.072 | 0.077 | |

**Note(s):**

1. 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
   - ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
   - ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz
2. Per KDB 941225 D05 SAR for LTE Devices v02, SAR test reduction is applied using the following criteria:
   - Testing for Low and High Channel is performed at the highest output power level for 1RB, and 50% RB configuration for that channel.
   - Testing for 100% RB configuration is performed at the highest output power level for 100% RB configuration across the Low, Mid and High Channel when the highest reported SAR for 1 RB and 50% RB are ≥ 0.8 W/kg. Testing for the remaining required channels is not needed because the reported SAR for 100% RB Allocation < 1.45 W/kg.
   - Testing for 16-QAM modulation is not required because the reported SAR for QPSK is < 1.45 W/Kg and its output power is not more than 0.5 dB higher than that of QPSK.
   - Testing for the other channel bandwidths is not required because the reported SAR for the highest channel bandwidth is < 1.45 W/Kg and its output power is not more than 0.5 dB higher than that of the highest channel bandwidth.
3. With headset attached. According to KDB 648474 Section 2.3, when the reported SAR for body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.


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## 11.5. LTE Band 17

| RF Exposure Conditions | Test Position | Mode | Dist. (mm) | Ch #. | Freq. (MHz) | RB Allocation | RB Offset | Power (dBm) | | 1-g SAR (W/kg) | | Plot No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Tune-up limit | Meas. | Meas. | Scaled | |
| Head | Left Touch | QPSK | N/A | 23790 | 710.0 | 1 | 0 | 22.0 | 21.8 | 0.004 | 0.005 | 10 |
| | | | | 23790 | 710.0 | 25 | 0 | 22.0 | 21.7 | <0.001 | <0.001 | |
| Head | Left Tilt | QPSK | N/A | 23790 | 710.0 | 1 | 0 | 22.0 | 21.8 | <0.001 | <0.001 | |
| | | | | 23790 | 710.0 | 25 | 0 | 22.0 | 21.7 | <0.001 | <0.001 | |
| Head | Right Touch | QPSK | N/A | 23790 | 710.0 | 1 | 0 | 22.0 | 21.8 | 0.003 | 0.003 | |
| | | | | 23790 | 710.0 | 25 | 0 | 22.0 | 21.7 | <0.001 | <0.001 | |
| Head | Right Tilt | QPSK | N/A | 23790 | 710.0 | 1 | 0 | 22.0 | 21.8 | <0.001 | <0.001 | |
| | | | | 23790 | 710.0 | 25 | 0 | 22.0 | 21.7 | <0.001 | <0.001 | |
| Body & Hotspot | Rear | QPSK | 10 | 23790 | 710.0 | 1 | 0 | 22.0 | 21.8 | 0.013 | 0.014 | 11 |
| | | | | 23790 | 710.0 | 25 | 0 | 22.0 | 21.7 | 0.010 | 0.010 | |
| Body & Hotspot | Front | QPSK | 10 | 23790 | 710.0 | 1 | 0 | 22.0 | 21.8 | 0.007 | 0.008 | |
| | | | | 23790 | 710.0 | 25 | 0 | 22.0 | 21.7 | 0.007 | 0.007 | |
| Hotspot | Edge 2 | QPSK | 10 | 23790 | 710.0 | 1 | 0 | 22.0 | 21.8 | 0.005 | 0.005 | |
| | | | | 23790 | 710.0 | 25 | 0 | 22.0 | 21.7 | 0.004 | 0.004 | |
| Hotspot | Edge 3 | QPSK | 10 | 23790 | 710.0 | 1 | 0 | 22.0 | 21.8 | 0.004 | 0.004 | |
| | | | | 23790 | 710.0 | 25 | 0 | 22.0 | 21.7 | 0.003 | 0.003 | |
| Hotspot | Edge 4 | QPSK | 10 | 23790 | 710.0 | 1 | 0 | 22.0 | 21.8 | 0.014 | 0.015 | 12 |
| | | | | 23790 | 710.0 | 25 | 0 | 22.0 | 21.7 | 0.011 | 0.012 | |

**Note(s):**

1. 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
   - ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
   - ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz
2. Per KDB 941225 D05 SAR for LTE Devices v02, SAR test reduction is applied using the following criteria:
   - Testing for Low and High Channel is performed at the highest output power level for 1RB, and 50% RB configuration for that channel.
   - Testing for 100% RB configuration is performed at the highest output power level for 100% RB configuration across the Low, Mid and High Channel when the highest reported SAR for 1 RB and 50% RB are ≥ 0.8 W/kg. Testing for the remaining required channels is not needed because the reported SAR for 100% RB Allocation < 1.45 W/kg.
   - Testing for 16-QAM modulation is not required because the reported SAR for QPSK is < 1.45 W/Kg and its output power is not more than 0.5 dB higher than that of QPSK.
   - Testing for the other channel bandwidths is not required because the reported SAR for the highest channel bandwidth is < 1.45 W/Kg and its output power is not more than 0.5 dB higher than that of the highest channel bandwidth.
3. With headset attached. According to KDB 648474 Section 2.3, when the reported SAR for body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.


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## 11.6. Wi-Fi (DTS Band)

| RF Exposure Conditions | Test Position | Mode | Dist. (mm) | Ch #. | Freq. (MHz) | Power (dBm) | | 1-g SAR (W/kg) | | Plot No. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Tune-up limit | Meas. | Meas. | Scaled | |
| Head | Left Touch | 802.11b | N/A | 6 | 2437 | 17.5 | 16.8 | 0.143 | 0.168 | |
| Head | Left Tilt | 802.11b | N/A | 6 | 2437 | 17.5 | 16.8 | 0.128 | 0.150 | |
| Head | Right Touch | 802.11b | N/A | 6 | 2437 | 17.5 | 16.8 | 0.256 | 0.301 | |
| Head | Right Tilt | 802.11b | N/A | 6 | 2437 | 17.5 | 16.8 | 0.208 | 0.244 | |
| Body & Hotspot | Rear | 802.11b | 10 | 6 | 2437 | 17.5 | 16.8 | 0.088 | 0.103 | |
| Body & Hotspot | Front | 802.11b | 10 | 6 | 2437 | 17.5 | 16.8 | 0.101 | 0.119 | |
| Hotspot | Edge 1 | 802.11b | 10 | 6 | 2437 | 17.5 | 16.8 | 0.073 | 0.086 | |
| Hotspot | Edge 2 | 802.11b | 10 | 6 | 2437 | 17.5 | 16.8 | 0.012 | 0.014 | |
| Hotspot | Edge 4 | 802.11b | 10 | 6 | 2437 | 17.5 | 16.8 | 0.021 | 0.025 | |
| RF Exposure Conditions | Test Position | Mode | Dist. (mm) | Ch #. | Freq. (MHz) | Power (dBm) | | 1-g SAR (W/kg) | | Plot No. |
| | | | | | | Tune-up limit | Meas. | Meas. | Scaled | |
| Head | Left Touch | 802.11a | N/A | 149 | 5745 | 11.5 | 11.2 | 1.020 | **1.093** | 13 |
| | | | | 157 | 5785 | 11.5 | 11.2 | 0.897 | 0.961 | |
| | | | | 165 | 5825 | 11.5 | 11.1 | 0.834 | 0.914 | |
| Head | Left Tilt | 802.11a | N/A | 149 | 5745 | 11.5 | 11.2 | 0.721 | 0.773 | |
| | | | | 157 | 5785 | 11.5 | 11.2 | 0.613 | 0.657 | |
| | | | | 165 | 5825 | 11.5 | 11.1 | 0.596 | 0.654 | |
| Head | Right Touch | 802.11a | N/A | 149 | 5745 | 11.5 | 11.2 | 0.780 | 0.836 | |
| | | | | 157 | 5785 | 11.5 | 11.2 | 0.774 | 0.829 | |
| | | | | 165 | 5825 | 11.5 | 11.1 | 0.699 | 0.766 | |
| Head | Right Tilt | 802.11a | N/A | 149 | 5745 | 11.5 | 11.2 | 0.779 | 0.835 | |
| | | | | 157 | 5785 | 11.5 | 11.2 | 0.759 | 0.813 | |
| | | | | 165 | 5825 | 11.5 | 11.1 | 0.678 | 0.743 | |
| Body & Hotspot | Rear | 802.11a | 10 | 149 | 5745 | 11.5 | 11.2 | 0.122 | 0.131 | |
| Body & Hotspot | Front | 802.11a | 10 | 149 | 5745 | 11.5 | 11.2 | 0.284 | **0.304** | 14 |
| Hotspot | Edge 1 | 802.11a | 10 | 149 | 5745 | 11.5 | 11.2 | 0.337 | **0.361** | 15 |
| Hotspot | Edge 2 | 802.11a | 10 | 149 | 5745 | 11.5 | 11.2 | 0.022 | 0.024 | |
| Hotspot | Edge 4 | 802.11a | 10 | 149 | 5745 | 11.5 | 11.2 | 0.079 | 0.085 | |
| RF Exposure Conditions | Test Position | Mode | Dist. (mm) | Ch #. | Freq. (MHz) | Power (dBm) | | 1-g SAR (W/kg) | | Plot No. |
| | | | | | | Tune-up limit | Meas. | Meas. | Scaled | |
| Head | Left Touch | 802.11ac | N/A | 155 | 5775 | 9.5 | 8.9 | 0.400 | 0.459 | |
| Body & Hotspot | Front | 802.11ac | N/A | 155 | 5775 | 9.5 | 8.9 | 0.039 | 0.045 | |
| Hotspot | Edge 1 | 802.11ac | N/A | 155 | 5775 | 9.5 | 8.9 | 0.081 | 0.093 | |

**Note(s):**

1. 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
   - ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
   - ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz
2. Apply usual 802.11 test exclusion considerations, but include 802.11ac for highest SAR configuration in each frequency band and each exposure condition according to April 2013 TCB Workshop Updates.
3. With headset attached. According to KDB 648474 Section 2.3, when the reported SAR for body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.


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## 11.7. Wi-Fi (UNII Band)

| RF Exposure Conditions | Test Position | Mode | Dist. (mm) | Ch #. | Freq. (MHz) | Power (dBm) | | 1-g SAR (W/kg) | | Plot No. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Tune-up limit | Meas. | Meas. | Scaled | |
| Head | Left Touch | 802.11a | N/A | 48 | 5240 | 11.5 | 11.2 | 0.468 | 0.501 | |
| | | | | 60 | 5300 | 11.5 | 10.9 | 0.398 | 0.457 | |
| | | | | 104 | 5520 | 11.5 | 11.1 | 0.797 | 0.874 | |
| | | | | 112 | 5560 | 11.5 | 11.0 | 0.856 | 0.960 | |
| | | | | 120 | 5600 | 11.5 | 10.9 | 0.918 | **1.054** | 16 |
| | | | | 136 | 5680 | 11.5 | 10.7 | 0.825 | 0.992 | |
| Head | Left Tilt | 802.11a | N/A | 48 | 5240 | 11.5 | 11.2 | 0.417 | 0.447 | |
| | | | | 60 | 5300 | 11.5 | 10.9 | 0.433 | 0.497 | |
| | | | | 104 | 5520 | 11.5 | 11.1 | 0.530 | 0.581 | |
| | | | | 112 | 5560 | 11.5 | 11.0 | 0.627 | 0.704 | |
| | | | | 120 | 5600 | 11.5 | 10.9 | 0.626 | 0.719 | |
| | | | | 136 | 5680 | 11.5 | 10.7 | 0.720 | 0.866 | |
| Head | Right Touch | 802.11a | N/A | 48 | 5240 | 11.5 | 11.2 | 0.348 | 0.373 | |
| | | | | 60 | 5300 | 11.5 | 10.9 | 0.366 | 0.420 | |
| | | | | 104 | 5520 | 11.5 | 11.1 | 0.670 | 0.735 | |
| | | | | 112 | 5560 | 11.5 | 11.0 | 0.730 | 0.819 | |
| | | | | 120 | 5600 | 11.5 | 10.9 | 0.744 | 0.854 | |
| | | | | 136 | 5680 | 11.5 | 10.7 | 0.695 | 0.836 | |
| Head | Right Tilt | 802.11a | N/A | 48 | 5240 | 11.5 | 11.2 | 0.362 | 0.388 | |
| | | | | 60 | 5300 | 11.5 | 10.9 | 0.360 | 0.413 | |
| | | | | 104 | 5520 | 11.5 | 11.1 | 0.632 | 0.693 | |
| | | | | 112 | 5560 | 11.5 | 11.0 | 0.683 | 0.766 | |
| | | | | 120 | 5600 | 11.5 | 10.9 | 0.696 | 0.799 | |
| | | | | 136 | 5680 | 11.5 | 10.7 | 0.737 | 0.886 | |
| Body | Rear | 802.11a | 10 | 48 | 5240 | 11.5 | 11.2 | 0.180 | 0.193 | |
| | | | | 60 | 5300 | 11.5 | 10.9 | 0.197 | 0.226 | |
| | | | | 104 | 5520 | 11.5 | 11.1 | 0.215 | 0.236 | |
| Body | Front | 802.11a | 10 | 48 | 5240 | 11.5 | 11.2 | 0.127 | 0.136 | |
| | | | | 60 | 5300 | 11.5 | 10.9 | 0.170 | 0.195 | |
| | | | | 104 | 5520 | 11.5 | 11.1 | 0.262 | **0.287** | 17 |
| RF Exposure Conditions | Test Position | Mode | Dist. (mm) | Ch #. | Freq. (MHz) | Power (dBm) | | 1-g SAR (W/kg) | | Plot No. |
| | | | | | | Tune-up limit | Meas. | Meas. | Scaled | |
| Head | Left Touch | 802.11ac | N/A | 122 | 5610 | 9.5 | 8.9 | 0.354 | 0.406 | |
| Body | Front | 802.11ac | N/A | 122 | 5610 | 9.5 | 8.9 | 0.046 | 0.053 | |

**Note(s):**

1. 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
   - ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
   - ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz
2. Apply usual 802.11 test exclusion considerations, but include 802.11ac for highest SAR configuration in each frequency band and each exposure condition according to April 2013 TCB Workshop Updates.
3. With headset attached. According to KDB 648474 Section 2.3, when the reported SAR for body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.


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## 11.8. Bluetooth

| RF Exposure Conditions | Test Position | Mode | Dist. (mm) | Ch #. | Freq. (MHz) | Power (dBm) | | 1-g SAR (W/kg) | | Plot No. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Tune-up limit | Meas. | Meas. | Scaled | |
| Body | Rear | GFSK | 10 | 39 | 2441 | 8.5 | 8.4 | 0.001 | 0.001 | |
| Body | Front | GFSK | 10 | 39 | 2441 | 8.5 | 8.4 | 0.005 | 0.005 | 18 |

**Note(s):**

1. 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
   - ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
   - ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz
2. With headset attached. According to KDB 648474 Section 2.3, when the reported SAR for body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.


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# 12. SAR Measurement Variability

In accordance with published RF Exposure KDB procedure 865664 D01 SAR measurement 100 MHz to 6 GHz v01r01. 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.

## 12.1. The Highest Measured SAR Configuration in Each Frequency Band

| Frequency Band (MHz) | Air Interface | Head (W/kg) | Body-worn Accessory (W/kg) | Hotspot/WiFi Direct (W/kg) |
|---|---|---|---|---|
| 700 | LTE Band 17 | <0.8 W/kg | <0.8 W/kg | <0.8 W/kg |
| 850 | WCDMA Band V | <0.8 W/kg | <0.8 W/kg | <0.8 W/kg |
| | LTE Band 5 | <0.8 W/kg | <0.8 W/kg | <0.8 W/kg |
| 1900 | GSM 1900 | <0.8 W/kg | <0.8 W/kg | <0.8 W/kg |
| | WCDMA Band II | <0.8 W/kg | <0.8 W/kg | <0.8 W/kg |
| 2400 | WiFi 802.11b/g/n | <0.8 W/kg | <0.8 W/kg | <0.8 W/kg |
| 5000 | WiFi 802.11a/n/ac | 1.020 W/kg | | |

## 12.2. Repeated Measurement Results

### Head Exposure Condition

| Frequency band | Test Position | Mode | Ch #. | Freq. (MHz) | Meas. SAR (W/kg) | | Largest to Smallest SAR Ratio | Note |
|---|---|---|---|---|---|---|---|---|
| | | | | | Original | Repeated | | |
| WiFi 5 GHz | Left Touch | 802.11a | 149 | 5745 | 1.020 | 1.010 | 1.01 | 1 |

### Body-worn Accessory Exposure Condition

Not Applicable.

### Hotspot Mode Exposure Conditions

Not Applicable.

**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.


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# 13. 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 draft 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:

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


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## 13.1. Sum of the SAR for GSM1900 & WiFi & BT

| RF Exposure conditions | Test Position | Simultaneous Transmission Scenario | | | | ∑ 1-g SAR (mW/g) | SPLSR (Yes/ No) |
|---|---|---|---|---|---|---|---|
| | | GSM 1900 | WiFi DTS Band | WiFi UNII Band | Bluetooth | | |
| Head | Left Touch | 0.125 | 1.093 | | | 1.218 | No |
| | | 0.125 | | 1.054 | | 1.179 | No |
| | Left Tilt | 0.020 | 0.773 | | | 0.793 | No |
| | | 0.020 | | 0.866 | | 0.886 | No |
| | Right Touch | 0.084 | 0.836 | | | 0.920 | No |
| | | 0.084 | | 0.854 | | 0.938 | No |
| | Right Tilt | 0.031 | 0.835 | | | 0.866 | No |
| | | 0.031 | | 0.886 | | 0.917 | No |
| Body-worn Accessory & Hotspot | Rear | 0.502 | 0.131 | | | 0.633 | No |
| | | 0.502 | | 0.236 | | 0.738 | No |
| | | 0.502 | | | 0.001 | 0.503 | No |
| | Front | 0.391 | 0.304 | | | 0.695 | No |
| | | 0.391 | | 0.287 | | 0.678 | No |
| | | 0.391 | | | 0.005 | 0.396 | No |
| Hotspot | Edge 1 | 0 | 0.361 | | | 0.361 | No |
| | Edge 2 | 0.050 | 0.024 | | | 0.074 | No |
| | Edge 3 | 0.370 | 0 | | | 0 | No |
| | Edge 4 | 0.220 | 0.085 | | | 0.305 | No |

**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.

## 13.2. Sum of the SAR for W-CDMA Band V & WiFi & BT

| RF Exposure conditions | Test Position | Simultaneous Transmission Scenario | | | | ∑ 1-g SAR (mW/g) | SPLSR (Yes/ No) |
|---|---|---|---|---|---|---|---|
| | | W-CDMA Band V | WiFi DTS Band | WiFi UNII Band | Bluetooth | | |
| Head | Left Touch | 0.111 | 1.093 | | | 1.204 | No |
| | | 0.111 | | 1.054 | | 1.165 | No |
| | Left Tilt | 0.064 | 0.773 | | | 0.837 | No |
| | | 0.064 | | 0.866 | | 0.930 | No |
| | Right Touch | 0.094 | 0.836 | | | 0.930 | No |
| | | 0.094 | | 0.854 | | 0.948 | No |
| | Right Tilt | 0.060 | 0.835 | | | 0.895 | No |
| | | 0.060 | | 0.886 | | 0.946 | No |
| Body-worn Accessory & Hotspot | Rear | 0.147 | 0.131 | | | 0.278 | No |
| | | 0.147 | | 0.236 | | 0.383 | No |
| | | 0.147 | | | 0.001 | 0.148 | No |
| | Front | 0.101 | 0.304 | | | 0.405 | No |
| | | 0.101 | | 0.287 | | 0.388 | No |
| | | 0.101 | | | 0.005 | 0.106 | No |
| Hotspot | Edge 1 | 0 | 0.361 | | | 0.361 | No |
| | Edge 2 | 0.062 | 0.024 | | | 0.086 | No |
| | Edge 3 | 0.064 | 0 | | | 0 | No |
| | Edge 4 | 0.096 | 0.085 | | | 0.181 | No |

**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.


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## 13.3. Sum of the SAR for W-CDMA Band II & WiFi & BT

| RF Exposure conditions | Test Position | Simultaneous Transmission Scenario | | | | ∑ 1-g SAR (mW/g) | SPLSR (Yes/ No) |
|---|---|---|---|---|---|---|---|
| | | W-CDMA Band II | WiFi DTS Band | WiFi UNII Band | Bluetooth | | |
| Head | Left Touch | 0.152 | 1.093 | | | **1.245** | No |
| | | 0.152 | | 1.054 | | **1.206** | No |
| | Left Tilt | 0.020 | 0.773 | | | 0.793 | No |
| | | 0.020 | | 0.866 | | 0.886 | No |
| | Right Touch | 0.149 | 0.836 | | | 0.985 | No |
| | | 0.149 | | 0.854 | | 1.003 | No |
| | Right Tilt | 0.044 | 0.835 | | | 0.879 | No |
| | | 0.044 | | 0.886 | | 0.930 | No |
| Body-worn Accessory & Hotspot | Rear | 0.492 | 0.131 | | | 0.623 | No |
| | | 0.492 | | 0.236 | | 0.728 | No |
| | | 0.492 | | | 0.001 | 0.493 | No |
| | Front | 0.360 | 0.304 | | | 0.664 | No |
| | | 0.360 | | 0.287 | | 0.647 | No |
| | | 0.360 | | | 0.005 | 0.365 | No |
| Hotspot | Edge 1 | 0 | 0.361 | | | 0.361 | No |
| | Edge 2 | 0.053 | 0.024 | | | 0.077 | No |
| | Edge 3 | 0.383 | 0 | | | 0 | No |
| | Edge 4 | 0.204 | 0.085 | | | 0.289 | No |

**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.

## 13.4. Sum of the SAR for LTE Band 5 & WiFi & BT

| RF Exposure conditions | Test Position | Simultaneous Transmission Scenario | | | | ∑ 1-g SAR (mW/g) | SPLSR (Yes/ No) |
|---|---|---|---|---|---|---|---|
| | | LTE Band 5 | WiFi DTS Band | WiFi UNII Band | Bluetooth | | |
| Head | Left Touch | 0.072 | 1.093 | | | 1.165 | No |
| | | 0.072 | | 1.054 | | 1.126 | No |
| | Left Tilt | 0.061 | 0.773 | | | 0.834 | No |
| | | 0.061 | | 0.866 | | 0.927 | No |
| | Right Touch | 0.069 | 0.836 | | | 0.905 | No |
| | | 0.069 | | 0.854 | | 0.923 | No |
| | Right Tilt | 0.054 | 0.835 | | | 0.889 | No |
| | | 0.054 | | 0.886 | | 0.940 | No |
| Body-worn Accessory & Hotspot | Rear | 0.134 | 0.131 | | | 0.265 | No |
| | | 0.134 | | 0.236 | | 0.370 | No |
| | | 0.134 | | | 0.001 | 0.135 | No |
| | Front | 0.106 | 0.304 | | | 0.410 | No |
| | | 0.106 | | 0.287 | | 0.393 | No |
| | | 0.106 | | | 0.005 | 0.111 | No |
| Hotspot | Edge 1 | 0 | 0.361 | | | 0.361 | No |
| | Edge 2 | 0.076 | 0.024 | | | 0.100 | No |
| | Edge 3 | 0.102 | 0 | | | 0 | No |
| | Edge 4 | 0.077 | 0.085 | | | 0.162 | No |

**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.


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## 13.5. Sum of the SAR for LTE Band 17 & WiFi & BT

| RF Exposure conditions | Test Position | Simultaneous Transmission Scenario | | | | ∑ 1-g SAR (mW/g) | SPLSR (Yes/ No) |
|---|---|---|---|---|---|---|---|
| | | LTE Band 17 | WiFi DTS Band | WiFi UNII Band | Bluetooth | | |
| Head | Left Touch | 0.005 | 1.093 | | | 1.098 | No |
| | | 0.005 | | 1.054 | | 1.059 | No |
| | Left Tilt | 0.001 | 0.773 | | | 0.774 | No |
| | | 0.001 | | 0.866 | | 0.867 | No |
| | Right Touch | 0.003 | 0.836 | | | 0.839 | No |
| | | 0.003 | | 0.854 | | 0.857 | No |
| | Right Tilt | 0.001 | 0.835 | | | 0.836 | No |
| | | 0.001 | | 0.886 | | 0.887 | No |
| Body-worn Accessory & Hotspot | Rear | 0.014 | 0.131 | | | 0.145 | No |
| | | 0.014 | | 0.236 | | 0.250 | No |
| | | 0.014 | | | 0.001 | 0.015 | No |
| | Front | 0.008 | 0.304 | | | 0.312 | No |
| | | 0.008 | | 0.287 | | 0.295 | No |
| | | 0.008 | | | 0.005 | 0.013 | No |
| Hotspot | Edge 1 | 0 | 0.361 | | | 0.361 | No |
| | Edge 2 | 0.005 | 0.024 | | | 0.029 | No |
| | Edge 3 | 0.004 | 0 | | | 0 | No |
| | Edge 4 | 0.015 | 0.085 | | | 0.100 | No |

**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.


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# 14. Appendixes

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

**14.1. System Performance Check Plots**

**14.2. Highest SAR Test Plots**

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

**14.4. Calibration Certificate for E-Field Probe EX3DV4 - SN 3902**

**14.5. Calibration Certificate for E-Field Probe EX3DV4 - SN 3929**

**14.6. Calibration Certificate for D750V3 - SN 1019**

**14.7. Calibration Certificate for D850V2- SN 4d002**

**14.8. Calibration Certificate for D1900V2- SN 5d043**

**14.9. Calibration Certificate for D2450V2 - SN 899**

**14.10. Calibration Certificate for D5GHzV2 - SN 1138**


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