# SAR EVALUATION REPORT

**IEEE Std 1528-2013**

*For*

**GSM/CDMA/WCDMA/LTE Phone with BT, DTS/UNII a/b/g/n/ac, ANT+ and NFC**

**FCC ID: A3LSMA7050**
**Model Name: SM-A7050**

**Report Number: 12737383-S1V3**
**Issue Date: 4/3/2019**

*Prepared for*

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NVLAP LAB CODE 200065-0

## Revision History

| Rev. | Date | Revisions | Revised By |
|---|---|---|---|
| V1 | 3/22/2019 | Initial Issue | -- |
| V2 | 4/1/2019 | Updated EUT Description | Coltyce Sanders |
| V3 | 4/3/2019 | Section 6.5: Update Power Back-off description | Coltyce Sanders |
| | | | |


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# 1. Attestation of Test Results

| | | | | | |
|---|---|---|---|---|---|
| Applicant Name | | Samsung Electronics Co. Ltd | | | |
| FCC ID | | A3LSMA7050 | | | |
| Model Name | | SM-A7050 | | | |
| Applicable Standards | | Published RF exposure KDB procedures<br>IEEE Std 1528-2013 | | | |
| Exposure Category | | SAR Limits (W/Kg) | | | |
| | | Peak spatial-average (1g of tissue) | | Extremities (hands, wrists, ankles, etc.) (10g of tissue) | |
| General population / Uncontrolled exposure | | 1.6 | | 4 | |
| RF Exposure Conditions | | Equipment Class - Highest Reported SAR (W/kg) | | | |
| | | PCE | DTS | NII | DSS |
| Head | | 0.447 | 0.066 | 0.186 | 0.017 |
| Body-worn | | 0.250 | 0.094 | 0.580 | 0.001 |
| Hotspot | | 0.561 | 0.239 | 0.545 | 0.012 |
| Product specific 10g SAR | | N/A | N/A | 2.967 | N/A |
| Simultaneous TX | Head | 0.633 | 0.513 | 0.633 | 0.464 |
| | Body-worn | 0.830 | 0.344 | 0.830 | 0.251 |
| | Hotspot | 1.106 | 0.800 | 1.106 | 0.573 |
| Date Tested | | 2/26/2019 to 3/15/2019 and 3/20/2019 to 3/21/2019 | | | |
| Test Results | | Pass | | | |

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.
The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.
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 the U.S. government.

| Approved & Released By: | Prepared By: |
|---|---|
| Devin Chang<br>Senior Test Engineer<br>UL Verification Services Inc. | Coltyce Sanders<br>Senior Test Engineer<br>UL Verification Services Inc. |


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# 2. Test Specification, Methods and Procedures

The tests documented in this report were performed in accordance with FCC 47 CFR § 2.1093, IEEE STD 1528-2013, the following FCC Published RF exposure KDB procedures:

- 248227 D01 802.11 Wi-Fi SAR v02r02
- 447498 D01 General RF Exposure Guidance v06
- 447498 D03 Supplement C Cross-Reference v01
- 648474 D04 Handset SAR v01r03
- 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04
- 865664 D02 RF Exposure Reporting v01r02
- 941225 D01 3G SAR Procedures v03r01
- 941225 D05 SAR for LTE Devices v02r05
- 941225 D05A LTE Rel.10 KDB Inquiry Sheet v01r02
- 941225 D06 Hotspot Mode v02r01

In addition to the above, the following information was used:

- TCB workshop October 2015; RF Exposure Procedures (KDB 941225 D05A)
- TCB workshop April 2016; RF Exposure Procedures (LTE Carrier Aggregation for DL)
- TCB workshop October 2016; RF Exposure Procedures (Bluetooth Duty Factor)
- TCB workshop October 2016; RF Exposure Procedures (DUT Holder Perturbations)
- TCB workshop May 2017; RF Exposure Procedures (Broadband Liquid Above 3 GHz)
- TCB workshop November 2017; RF Exposure Procedures (Uplink CA SAR Test Guidance)
- TCB workshop April 2018; RF Exposure Procedures (LTE DL CA SAR Test Exclusion)

# 3. Facilities and Accreditation

The test sites and measurement facilities used to collect data are located at

| 47173 Benicia Street | 47266 Benicia Street |
|---|---|
| SAR Lab A | SAR Lab 1 |
| SAR Lab B | SAR Lab 2 |
| SAR Lab C | SAR Lab 3 |
| SAR Lab D | SAR Lab 4 |
| SAR Lab E | SAR Lab 5 |
| SAR Lab F | |
| SAR Lab G | |
| SAR Lab H | |

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0.


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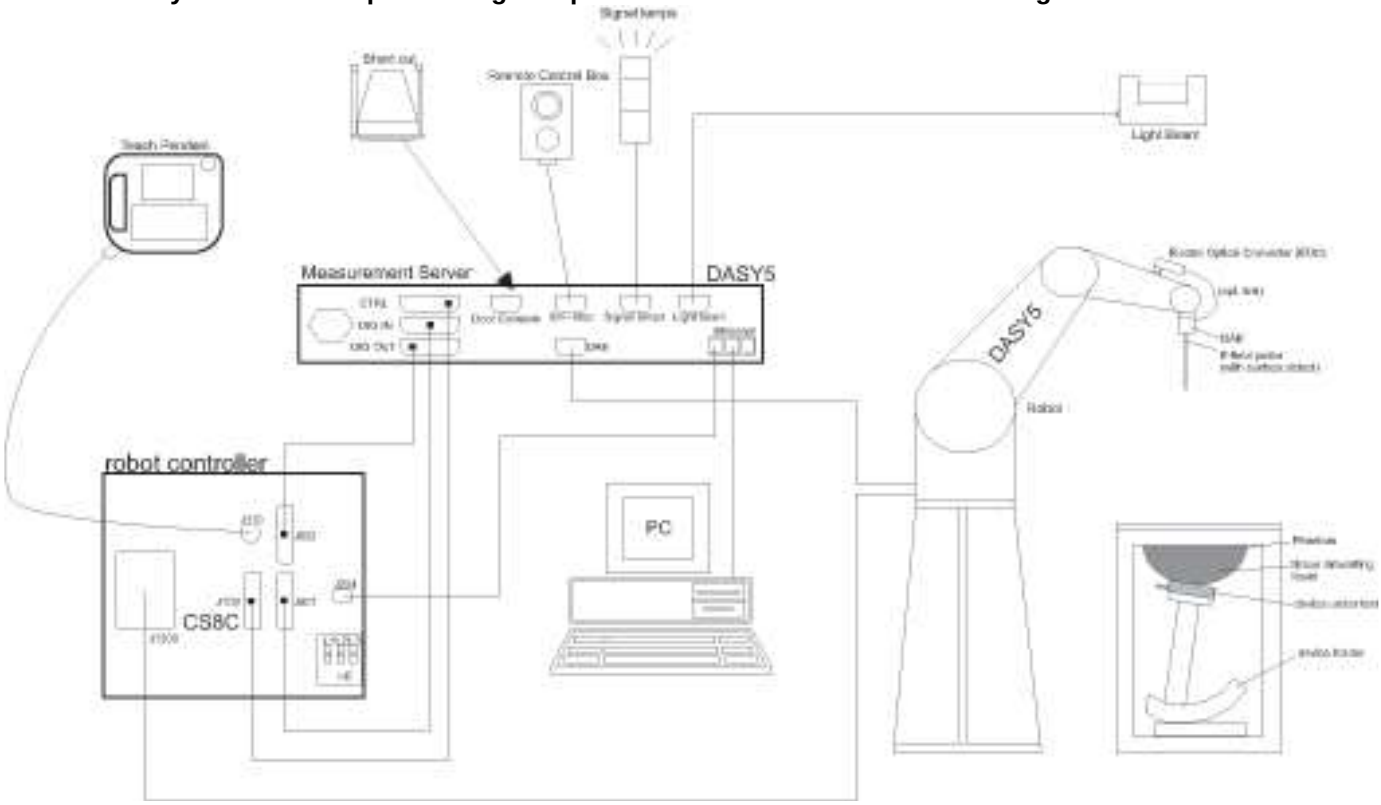
# 4. SAR Measurement System & Test Equipment

## 4.1. SAR Measurement System

**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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## 4.2. SAR Scan Procedures

**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

| | ≤ 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

| | | | ≤ 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.


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## 4.3. Test Equipment

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.

**Equipment used during Test Dates 2/26/2019 to 3/15/2019:**

| Name of Equipment | Manufacturer | Type/Model | Serial No. | Cal. Due Date |
|---|---|---|---|---|
| Network Analyzer | R&S | ZNLE6 | 101273-VA | 7/16/2019 |
| Dielectric Probe kit | SPEAG | DAK-3.5 | 1082 | 9/11/2019 |
| Shorting block | SPEAG | DAK-3.5 Short | SM DAK 200 BA | 9/11/2019 |
| Thermometer | Fisher Scientific | Traceable | 170064398 | 3/31/2019 |

**System Check**

| Name of Equipment | Manufacturer | Type/Model | Serial No. | Cal. Due Date |
|---|---|---|---|---|
| Signal Generator | Rhode & Schwarz | SMB100A | 180970 | 2/13/2020 |
| Power Sensor | Rhode & Schwarz | NRP18A | 100994 | 2/15/2020 |
| Synthesized Signal Generator | Agilent | N5181A | MY50140610 | 1/31/2020 |
| Power Meter | Keysight | N1912A | MY50001018 | 1/30/2020 |
| Power Sensor | Agilent | N1921A | MY53020038 | 4/23/2019 |
| Power Sensor | Agilent | N1921A | MY52260009 | 2/5/2020 |
| Amplifier | MITEQ | AMF-4D-00400600-50-30P | 1795092 | N/A |
| Directional coupler | Werlatone | C8060-102 | 2149 | N/A |
| DC Power Supply | Sorensen | XT 15-4 | 1817A02680 | N/A |

**Lab Equipment**

| Name of Equipment | Manufacturer | Type/Model | Serial No. | Cal. Due Date |
|---|---|---|---|---|
| E-Field Probe (SAR Lab E) | SPEAG | EX3DV4 | 3990 | 8/17/2019 |
| E-Field Probe (SAR Lab F) | SPEAG | EX3DV4 | 3902 | 5/24/2019 |
| E-Field Probe (SAR Lab G) | SPEAG | EX3DV4 | 7463 | 7/20/2019 |
| E-Field Probe (SAR Lab H) | SPEAG | EX3DV4 | 7482 | 7/23/2019 |
| Data Acquisition Electronics (SAR Lab E) | SPEAG | DAE4 | 1548 | 5/3/2019 |
| Data Acquisition Electronics (SAR Lab F) | SPEAG | DAE4 | 1439 | 7/10/2019 |
| Data Acquisition Electronics (SAR Lab G) | SPEAG | DAE4 | 1257 | 9/14/2019 |
| Data Acquisition Electronics (SAR Lab H) | SPEAG | DAE4 | 1239 | 7/11/2019 |
| System Validation Dipole | SPEAG | D835V2 | 4d142 | 8/23/2019 |
| System Validation Dipole | SPEAG | D835V2 | 4d117 | 5/16/2019 |
| System Validation Dipole | SPEAG | D1900V2 | 5d140 | 4/11/2019 |
| System Validation Dipole | SPEAG | D2450V2 | 889 | 3/16/2019 |
| System Validation Dipole | SPEAG | D2600V2 | 1006 | 10/16/2019 |
| System Validation Dipole | SPEAG | D5GHzV2 | 1138 | 8/21/2019 |

**Other**

| Name of Equipment | Manufacturer | Type/Model | Serial No. | Cal. Due Date |
|---|---|---|---|---|
| Power Meter | Agilent | N1912A | MY55196004 | 1/30/2020 |
| Power Sensor | Agilent | N1921A | MY52270022 | 2/6/2020 |
| Base Station Simulator | R & S | CMW500 | 135384 | 2/16/2020 |
| Base Station Simulator | R & S | CBT Bluetooth Tester | 100987 | 2/14/2020 |
| PXA Spectrum Analyzer | Agilent | N9030A | MY53310968 | 1/23/2020 |


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**Equipment used during Test Dates 3/20/2019 to 3/21/2019:**

| Name of Equipment | Manufacturer | Type/Model | Serial No. | Cal. Due Date |
|---|---|---|---|---|
| Network Analyzer | R&S | ZNLE6 | 101273-VA | 7/16/2019 |
| Dielectric Probe kit | SPEAG | DAK-3.5 | 1082 | 9/11/2019 |
| Shorting block | SPEAG | DAK-3.5 Short | SM DAK 200 BA | 9/11/2019 |
| Thermometer | Fisher Scientific | Traceable | 170064398 | 3/31/2019 |

**System Check**

| Name of Equipment | Manufacturer | Type/Model | Serial No. | Cal. Due Date |
|---|---|---|---|---|
| Signal Generator | Rhode & Schwarz | SMB100A | 180970 | 2/13/2020 |
| Power Sensor | Rhode & Schwarz | NRP18A | 100994 | 2/15/2020 |

**Lab Equipment**

| Name of Equipment | Manufacturer | Type/Model | Serial No. | Cal. Due Date |
|---|---|---|---|---|
| E-Field Probe (SAR Lab 4) | SPEAG | EX3DV4 | 7356 | 4/24/2019 |
| Data Acquisition Electronics (SAR Lab 4) | SPEAG | DAE4 | 1547 | 5/3/2019 |
| System Validation Dipole | SPEAG | D2600V2 | 1006 | 10/16/2019 |

**Other**

| Name of Equipment | Manufacturer | Type/Model | Serial No. | Cal. Due Date |
|---|---|---|---|---|
| Base Station Simulator | R & S | CMW500 | 135384 | 2/16/2020 |

# 5. Measurement Uncertainty

Per KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg and the measured 10-g SAR within a frequency band is < 3.75 W/kg. The expanded SAR measurement uncertainty must be ≤ 30%, for a confidence interval of k = 2. If these conditions are met, extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval. Therefore, the measurement uncertainty is not required.


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# 6. Device Under Test (DUT) Information

## 6.1. DUT Description

| | |
|---|---|
| Device Dimension | Refer to Appendix A<br>This is a Phablet Device (display diagonal dimension > 15.0 cm or an overall diagonal dimension > 16.0 cm) |
| Back Cover | The Back Cover is not removable |
| Battery Options | The rechargeable battery is not user accessible. |
| Accessory | Headset |
| Wireless Router (Hotspot) | Wi-Fi Hotspot mode permits the device to share its cellular data connection with other Wi-Fi-enabled devices.<br>☒ Mobile Hotspot (Wi-Fi 2.4 GHz)<br>☒ Mobile Hotspot (Wi-Fi 5.8 GHz) |
| Wi-Fi Direct | Wi-Fi Direct enabled devices transfer data directly between each other.<br>Wi-Fi Direct is only available in hand use configurations.<br>☒ Wi-Fi Direct (Wi-Fi 2.4 GH z)<br>☒ Wi-Fi Direct (Wi-Fi 5.2/5.8 GHz) |
| Bluetooth Tethering (Hotspot) | BT Tethering mode permits the device to share its cellular data connection with other devices.<br>☒ BT Tethering (Bluetooth 2.4 GHz) |
| Test sample information | **S/N** / **IMEI** / **Notes**<br>R38M2074QKF / 355912100202131 / WWAN Conducted<br>R38M20759DP / 355911100208015 / WWAN Conducted<br>R38M2075HAA / 355911100210623 / WLAN Conducted<br>R38M2075V4R / 355911100214195 / WLAN Conducted<br>R38M207597E / 355911100207959 / WLAN Conducted<br>R38M207598Z / 355912100207965 / WWAN/WLAN Radiated<br>R38M2074Q7T / 355912100202016 / WWAN Radiated<br>R38M20759CH / 355912100208005 / WWAN Radiated<br>R38M207599M / 355912100207973 / WWAN/WLAN Radiated<br>R38020759FF / 355912100208039 / WWAN/WLAN Radiated<br>R38020759EL / 355912100208021 / WWAN/WLAN Radiated |
| Hardware Version | REV0.4 |
| Software Version | A7050.001 |


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## 6.2. Wireless Technologies

| Wireless technologies | Frequency bands | Operating Mode | | Duty Cycle used for SAR testing |
|---|---|---|---|---|
| GSM | 850<br>1900 | Voice (GMSK)<br>GPRS (GMSK)<br>EDGE (8PSK) | GSM Class : B<br>Multi-Slot Class:<br>Class 33 - 4 Up, 5 Down | GSM Voice: 12.5%<br>(E)GPRS: 1 Slot: 12.5%<br>2 Slots: 25%<br>3 Slots: 37.5%<br>4 Slots: 50% |
| | Does this device support DTM (Dual Transfer Mode)? ☐ Yes ☒ No | | | |
| | Does this device support SV-DO (1xRTT-1xEVDO)? ☐ Yes ☒ No | | | |
| CDMA (CDMA2000) | BC0 | 1xRTT (Voice & Data)<br>1xAdvanced<br>1xEV-DO Rel. 0<br>1xEV-DO Rev. A | | 100% |
| W-CDMA (UMTS) | Band II<br>Band V | UMTS Rel. 99 (Voice & Data)<br>HSDPA (Rel. 5)<br>HSUPA (Rel. 6)<br>HSPA+ (Rel. 7) DL only<br>DC-HSDPA (Rel. 8) | | 100% |
| LTE | FDD Band 5<br>TDD Band 41 | QPSK<br>16QAM<br>64AQM<br>Rel. 12 Carrier Aggregation | | 100% (FDD)<br>63.3% (TDD) Refer to §6.4 |
| | Does this device support SV-LTE (1xRTT-LTE)? ☐ Yes ☒ No | | | |
| Wi-Fi | 2.4 GHz | 802.11b<br>802.11g<br>802.11n (HT20) | | 98.47% (802.11b) [1] |
| | 5 GHz | 802.11a<br>802.11n (HT20)<br>802.11n (HT40)<br>802.11ac (VHT20)<br>802.11ac (VHT40)<br>802.11ac (VHT80) | | 97.39% (802.11n HT20) [2]<br>90.14% (802.11ac VHT80) [2] |
| | Does this device support bands 5.60 ~ 5.65 GHz? ☒ Yes ☐ No | | | |
| | Does this device support Band gap channel(s)? ☒ Yes ☐ No | | | |
| Bluetooth | 2.4 GHz | BR, EDR, LE | | 77.01%[3] |

**Notes:**

1. Refer to §9.6 for measured Duty Cycle.
2. Refer to §9.7 for measured Duty Cycle.
3. Refer to §9.8 for measured Duty Cycle.


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## 6.3. General LTE SAR Test and Reporting Considerations

<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td rowspan="13">Frequency range, Channel Bandwidth, Numbers and Frequencies</td><td>
<table>
<tr><td rowspan="3">Band 5[1]</td><td colspan="6">Frequency range: 824 - 849 MHz (BW = 25 MHz)</td></tr>
<tr><td colspan="6">Channel Bandwidth</td></tr>
<tr><td>20 MHz</td><td>15 MHz</td><td>10 MHz [1]</td><td>5 MHz</td><td>3 MHz</td><td>1.4 MHz</td></tr>
<tr><td>Low</td><td></td><td></td><td>20450/ 829</td><td>20425/ 826.5</td><td>20415/ 825.5</td><td>20407/ 824.7</td></tr>
<tr><td>Mid</td><td></td><td></td><td>20525/ 836.5</td><td>20525/ 836.5</td><td>20525/ 836.5</td><td>20525/ 836.5</td></tr>
<tr><td>High</td><td></td><td></td><td>20600/ 844</td><td>20625/ 846.5</td><td>20635/ 847.5</td><td>20643/ 848.3</td></tr>
<tr><td rowspan="3">Band 41</td><td colspan="6">Frequency range: 2555 - 2655 MHz (BW = 100 MHz)</td></tr>
<tr><td colspan="6">Channel Bandwidth</td></tr>
<tr><td>20 MHz</td><td>15 MHz</td><td>10 MHz</td><td>5 MHz</td><td>3 MHz</td><td>1.4 MHz</td></tr>
<tr><td>Low</td><td>40340/ 2565</td><td>40315/ 2562.5</td><td>40290/ 2560</td><td>40625/ 2557.5</td><td></td><td></td></tr>
<tr><td>Mid</td><td>40740/ 2605</td><td>40740/ 2605</td><td>40740/ 2605</td><td>40740/ 2605</td><td></td><td></td></tr>
<tr><td>High</td><td>41140/ 2645</td><td>41165/ 2647.5</td><td>41190/ 2650</td><td>41215/ 2652.5</td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>LTE transmitter and antenna implementation</td><td>Refer to Appendix A.</td></tr>
<tr><td>Maximum power reduction (MPR)</td><td>
Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 1, 2 and 3
<table>
<tr><th rowspan="2">Modulation</th><th colspan="6">Channel bandwidth / Transmission bandwidth ($N_{RB}$)</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>
<tr><td>64 QAM</td><td>≤ 5</td><td>≤ 4</td><td>≤ 8</td><td>≤ 12</td><td>≤ 16</td><td>≤ 18</td><td>≤ 2</td></tr>
<tr><td>64 QAM</td><td>> 5</td><td>> 4</td><td>> 8</td><td>> 12</td><td>> 16</td><td>> 18</td><td>≤ 3</td></tr>
<tr><td>256 QAM</td><td colspan="6">≥ 1</td><td>≤ 5</td></tr>
</table>
MPR Built-in by design<br>
The manufacturer MPR values are always within the 3GPP maximum MPR allowance but may not follow the default MPR values.<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 base station 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>

**Notes:**

1. Maximum bandwidth 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 KDB 941225 D05 SAR for LTE Devices.
2. SAR Testing for LTE was performed with the same number of RB and RB offsets transmitting on all TTI frames (maximum TTI).


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## 6.4. LTE (TDD) Considerations

According to KDB 941225 D05 SAR for LTE Devices, for Time-Division Duplex (TDD) systems, SAR must be tested using a fixed periodic duty factor according to the highest transmission duty factor implemented for the device and supported by the defined 3GPP LTE TDD configurations.

LTE TDD Bands support 3GPP TS 36.211 section 4.2 for Type 2 Frame Structure and Table 4.2-2 for uplink-downlink configurations and Table 4.2-1 for Special subframe configurations.

Table 4.2-1: Configuration of special subframe (lengths of DwPTS/GP/UpPTS)

| Special subframe configuration | Normal cyclic prefix in downlink | | | Extended cyclic prefix in downlink | | |
|---|---|---|---|---|---|---|
| | DwPTS | UpPTS | | DwPTS | UpPTS | |
| | | Normal cyclic prefix in uplink | Extended cyclic prefix in uplink | | Normal cyclic prefix in uplink | Extended cyclic prefix in uplink |
| 0 | $6592 \cdot T_s$ | $(1+X) \cdot 2192 \cdot T_s$ | $(1+X) \cdot 2560 \cdot T_s$ | $7680 \cdot T_s$ | $(1+X) \cdot 2192 \cdot T_s$ | $(1+X) \cdot 2560 \cdot T_s$ |
| 1 | $19760 \cdot T_s$ | | | $20480 \cdot T_s$ | | |
| 2 | $21952 \cdot T_s$ | | | $23040 \cdot T_s$ | | |
| 3 | $24144 \cdot T_s$ | | | $25600 \cdot T_s$ | | |
| 4 | $26336 \cdot T_s$ | | | $7680 \cdot T_s$ | $(2+X) \cdot 2192 \cdot T_s$ | $(2+X) \cdot 2560 \cdot T_s$ |
| 5 | $6592 \cdot T_s$ | $(2+X) \cdot 2192 \cdot T_s$ | $(2+X) \cdot 2560 \cdot T_s$ | $20480 \cdot T_s$ | | |
| 6 | $19760 \cdot T_s$ | | | $23040 \cdot T_s$ | | |
| 7 | $21952 \cdot T_s$ | | | $12800 \cdot T_s$ | | |
| 8 | $24144 \cdot T_s$ | | | - | - | - |
| 9 | $13168 \cdot T_s$ | | | - | - | - |
| 10 | $13168 \cdot T_s$ | $13152 \cdot T_s$ | $12800 \cdot T_s$ | - | - | - |

Table 4.2-2: Uplink-downlink configurations & Calculated Duty Cycle

| Uplink-Downlink Configuration | Downlink-to-Uplink Switch-point Periodicity | Subframe Number | | | | | | | | | | Calculated Duty Cycle (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
| 0 | 5 ms | D | S | U | U | U | D | S | U | U | U | 63.3% |
| 1 | 5 ms | D | S | U | U | D | D | S | U | U | D | 43.3% |
| 2 | 5 ms | D | S | U | D | D | D | S | U | D | D | 23.3% |
| 3 | 10 ms | D | S | U | U | U | D | D | D | D | D | 31.7% |
| 4 | 10 ms | D | S | U | U | D | D | D | D | D | D | 21.7% |
| 5 | 10 ms | D | S | U | D | D | D | D | D | D | D | 11.7% |
| 6 | 5 ms | D | S | U | U | U | D | S | U | U | D | 53.3% |

Calculated Duty Cycle = Extended cyclic prefix in uplink * ($T_s$) * # of S + # of U / period

**Note(s):**

This device supports uplink-downlink configurations 0-6. The configuration with highest duty cycle was used for SAR Testing: configuration 0 at 63.3% duty cycle.



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## 6.5. Power Back-off Operation

This device supports multiple power back-off modes: WWAN (Hotspot), WWAN (Grip Sensor), and WLAN (RCV+IR Sensor). Each of the power back-off modes operate within specific exposure conditions for certain technologies.

WWAN (Hotspot) and WWAN (Grip Sensor) operate separately. Also, in a situation where both WWAN power back-off modes could be active, WWAN (Grip Sensor) power back-off takes priority.

WLAN back-off power supports a RCV+IR Sensor. This sensor activates in a held to ear exposure condition. When the sensor activates in this exposure condition, the output power level is reduced.

For full details on how each power back-off mode operates, refer to the Operational Description.

| Power Back-off mode | Technologies Supported | Exposure Conditions Active | | | |
|---|---|---|---|---|---|
| | | Head | Body-worn | Hotspot | Product Specific 10g |
| WWAN (Hotspot) | GSM 1900<br>W-CDMA B2 | N/A | N/A | ✓ | N/A |
| WWAN (Grip Sensor) | GSM 1900<br>W-CDMA B2<br>LTE B41 | N/A | N/A | N/A | ✓ |
| WLAN (Head) | Wi-Fi 2.4GHz<br>Wi-Fi 5GHz | ✓ | N/A | N/A | N/A |

**Note(s):**

Tune-Up Limits for WWAN (Hotspot) and WWAN (Grip Sensor) are both Reduced Average Powers. Please refer to §9 for all power measurements.


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# 7. RF Exposure Conditions (Test Configurations)

Refer to Appendix A for the specific details of the antenna-to-antenna and antenna-to-edge(s) distances.

| Wireless technologies | RF Exposure Conditions | DUT-to-User Separation | Test Position | Antenna-to-edge/surface | SAR Required | Note |
|---|---|---|---|---|---|---|
| WWAN (Main Ant. 1) | Head | 0 mm | Left Touch | N/A | Yes | |
| | | | Left Tilt (15°) | N/A | Yes | |
| | | | Right Touch | N/A | Yes | |
| | | | Right Tilt (15°) | N/A | Yes | |
| | Body | 15 mm | Rear | N/A | Yes | |
| | | | Front | N/A | Yes | |
| | Hotspot | 10 mm | Rear | < 25 mm | Yes | |
| | | | Front | < 25 mm | Yes | |
| | | | Edge 1 (Top) | > 25 mm | No | 1 |
| | | | Edge 2 (Right) | < 25 mm | Yes | |
| | | | Edge 3 (Bottom) | < 25 mm | Yes | |
| | | | Edge 4 (Left) | < 25 mm | Yes | |
| | Product Specifc 10g | 0 mm | Rear | Refer to notes 2 & 3 | | |
| | | | Front | | | |
| | | | Edge 1 (Top) | | | |
| | | | Edge 2 (Right) | | | |
| | | | Edge 3 (Bottom) | | | |
| | | | Edge 4 (Left) | | | |
| WWAN (Main Ant. 2) | Head | 0 mm | Left Touch | N/A | Yes | |
| | | | Left Tilt (15°) | N/A | Yes | |
| | | | Right Touch | N/A | Yes | |
| | | | Right Tilt (15°) | N/A | Yes | |
| | Body | 15 mm | Rear | N/A | Yes | |
| | | | Front | N/A | Yes | |
| | Hotspot | 10 mm | Rear | < 25 mm | Yes | |
| | | | Front | < 25 mm | Yes | |
| | | | Edge 1 (Top) | < 25 mm | Yes | |
| | | | Edge 2 (Right) | > 25 mm | No | 1 |
| | | | Edge 3 (Bottom) | > 25 mm | No | 1 |
| | | | Edge 4 (Left) | < 25 mm | Yes | |
| | Product Specifc 10g | 0 mm | Rear | Refer to notes 2 & 3 | | |
| | | | Front | | | |
| | | | Edge 1 (Top) | | | |
| | | | Edge 2 (Right) | | | |
| | | | Edge 3 (Bottom) | | | |
| | | | Edge 4 (Left) | | | |

**Notes:**

1. SAR is not required because the distance from the antenna to the edge is > 25 mm as per KDB 941225 D06 Hot Spot SAR.
2. For Phablet devices: when hotspot mode applies, Product Specific 10-g SAR is required only for the surfaces and edges with hotspot mode 1-g reported SAR > 1.2 W/kg.
3. For Phablet devices: when hotspot mode applies and power reduction applies to hotspot mode, Product Specific 10-g SAR is required for each test position that has an adjusted SAR to maximum power that is > 1.2 W/kg.
4. WWAN Main Antenna #2 supports LTE B41.


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| Wireless technologies | RF Exposure Conditions | DUT-to-User Separation | Test Position | Antenna-to-edge/surface | SAR Required | Note |
|---|---|---|---|---|---|---|
| WLAN | Head | 0 mm | Left Touch | N/A | Yes | |
| | | | Left Tilt (15°) | N/A | Yes | |
| | | | Right Touch | N/A | Yes | |
| | | | Right Tilt (15°) | N/A | Yes | |
| | Body | 15 mm | Rear | N/A | Yes | |
| | | | Front | N/A | Yes | |
| | Hotspot | 10 mm | Rear | < 25 mm | Yes | |
| | | | Front | < 25 mm | Yes | |
| | | | Edge 1 (Top) | < 25 mm | Yes | |
| | | | Edge 2 (Right) | < 25 mm | Yes | |
| | | | Edge 3 (Bottom) | > 25 mm | No | 1 |
| | | | Edge 4 (Left) | > 25 mm | No | 1 |
| | Product Specifc 10g | 0 mm | Rear | Refer to notes 2 & 3 | | |
| | | | Front | | | |
| | | | Edge 1 (Top) | | | |
| | | | Edge 2 (Right) | | | |
| | | | Edge 3 (Bottom) | | | |
| | | | Edge 4 (Left) | | | |

**Notes:**

1. SAR is not required because the distance from the antenna to the edge is > 25 mm as per KDB 941225 D06 Hot Spot SAR.
2. For Phablet devices: when Hotspot Mode is not supported, Product Specific 10-g SAR is required for all surfaces and edges with an antenna located at ≤ 25 mm from that surface or edge in direct contact with a flat phantom, to address interactive hand use exposure conditions.
3. For Phablet devices: when hotspot mode applies, Product Specific 10-g SAR is required only for the surfaces and edges with hotspot mode 1-g reported SAR > 1.2 W/kg.
4. Wi-Fi Direct is only available in Hand use configuration.


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# 8. Dielectric Property Measurements & System Check

## 8.1. Dielectric Property Measurements

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.

The dielectric constant (εr) and conductivity (σ) of typical tissue-equivalent media recipes are expected to be within ± 5% of the required target values; but for SAR measurement systems that have implemented the SAR error compensation algorithms documented in IEEE Std 1528-2013, to automatically compensate the measured SAR results for deviations between the measured and required tissue dielectric parameters, the tolerance for εr and σ may be relaxed to ± 10%. This is limited to frequencies ≤ 3 GHz.

**Tissue Dielectric Parameters**

FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

| 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 |

**IEEE Std 1528-2013**

Refer to Table 3 within the IEEE Std 1528-2013



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**Dielectric Property Measurements Results for Test Dates 2/26/2019 to 3/15/2019:**

| SAR Lab | Date | Band (MHz) | Tissue Type | Frequency (MHz) | Relative Permittivity (εr) | | | Conductivity (σ) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Measured | Target | Delta (%) | Measured | Target | Delta (%) |
| E | 3/11/2019 | 5600 | Head | 5600 | 35.09 | 35.53 | -1.25 | 5.00 | 5.06 | -1.25 |
| | | | | 5500 | 35.27 | 35.65 | -1.06 | 4.88 | 4.96 | -1.59 |
| | | | | 5725 | 34.81 | 35.39 | -1.64 | 5.16 | 5.19 | -0.60 |
| E | 3/11/2019 | 5600 | Body | 5600 | 48.09 | 48.48 | -0.80 | 5.72 | 5.76 | -0.71 |
| | | | | 5500 | 48.25 | 48.61 | -0.75 | 5.58 | 5.64 | -1.18 |
| | | | | 5725 | 47.82 | 48.31 | -1.01 | 5.91 | 5.91 | 0.02 |
| F | 2/26/2019 | 835 | Head | 835 | 40.06 | 41.50 | -3.47 | 0.88 | 0.90 | -2.02 |
| | | | | 805 | 40.02 | 41.68 | -3.98 | 0.87 | 0.90 | -2.76 |
| | | | | 850 | 39.99 | 41.50 | -3.64 | 0.89 | 0.92 | -2.97 |
| F | 2/26/2019 | 835 | Body | 835 | 53.51 | 55.20 | -3.06 | 0.95 | 0.97 | -1.66 |
| | | | | 805 | 53.48 | 55.33 | -3.35 | 0.94 | 0.97 | -2.39 |
| | | | | 850 | 53.43 | 55.16 | -3.13 | 0.96 | 0.99 | -2.69 |
| F | 3/4/2019 | 835 | Head | 835 | 40.10 | 41.50 | -3.37 | 0.89 | 0.90 | -0.61 |
| | | | | 805 | 40.10 | 41.68 | -3.79 | 0.89 | 0.90 | -1.08 |
| | | | | 850 | 40.02 | 41.50 | -3.57 | 0.90 | 0.92 | -1.70 |
| F | 3/4/2019 | 835 | Body | 835 | 54.65 | 55.20 | -1.00 | 0.97 | 0.97 | -0.32 |
| | | | | 805 | 54.65 | 55.33 | -1.24 | 0.96 | 0.97 | -0.88 |
| | | | | 850 | 54.57 | 55.16 | -1.06 | 0.97 | 0.99 | -1.50 |
| F | 3/11/2019 | 835 | Body | 835 | 53.63 | 55.20 | -2.84 | 0.98 | 0.97 | 0.52 |
| | | | | 805 | 53.68 | 55.33 | -2.99 | 0.96 | 0.97 | -0.40 |
| | | | | 850 | 53.60 | 55.16 | -2.82 | 0.98 | 0.99 | -0.57 |
| G | 2/26/2019 | 2450 | Head | 2450 | 37.50 | 39.20 | -4.34 | 1.80 | 1.80 | -0.11 |
| | | | | 2400 | 37.55 | 39.30 | -4.44 | 1.75 | 1.75 | 0.13 |
| | | | | 2480 | 37.48 | 39.16 | -4.30 | 1.82 | 1.83 | -0.90 |
| G | 2/26/2019 | 2450 | Body | 2450 | 50.56 | 52.70 | -4.06 | 2.04 | 1.95 | 4.36 |
| | | | | 2400 | 50.60 | 52.77 | -4.12 | 1.99 | 1.90 | 4.64 |
| | | | | 2480 | 50.53 | 52.66 | -4.05 | 2.06 | 1.99 | 3.30 |
| G | 3/4/2019 | 2600 | Head | 2600 | 40.22 | 39.01 | 3.10 | 1.98 | 1.96 | 0.76 |
| | | | | 2495 | 40.37 | 39.14 | 3.13 | 1.88 | 1.85 | 1.80 |
| | | | | 2690 | 40.01 | 38.90 | 2.86 | 2.06 | 2.06 | -0.17 |
| G | 3/4/2019 | 2600 | Body | 2600 | 52.81 | 52.51 | 0.57 | 2.09 | 2.16 | -3.32 |
| | | | | 2495 | 52.94 | 52.64 | 0.56 | 2.00 | 2.01 | -0.66 |
| | | | | 2690 | 52.62 | 52.40 | 0.43 | 2.17 | 2.29 | -4.95 |


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**Dielectric Property Measurements Results (continued):**

| SAR Lab | Date | Band (MHz) | Tissue Type | Frequency (MHz) | Relative Permittivity (εr) | | | Conductivity (σ) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Measured | Target | Delta (%) | Measured | Target | Delta (%) |
| G | 3/13/2019 | 5250 | Head | 5250 | 36.15 | 35.93 | 0.60 | 4.64 | 4.70 | -1.28 |
| | | | | 5150 | 36.34 | 36.05 | 0.81 | 4.53 | 4.60 | -1.52 |
| | | | | 5350 | 35.95 | 35.82 | 0.37 | 4.77 | 4.80 | -0.82 |
| G | 3/13/2019 | 5250 | Body | 5250 | 48.48 | 48.95 | -0.96 | 5.36 | 5.35 | 0.17 |
| | | | | 5150 | 48.67 | 49.09 | -0.85 | 5.22 | 5.24 | -0.37 |
| | | | | 5350 | 48.28 | 48.82 | -1.10 | 5.51 | 5.47 | 0.81 |
| G | 3/13/2019 | 5600 | Head | 5600 | 35.53 | 35.53 | -0.01 | 5.03 | 5.06 | -0.58 |
| | | | | 5500 | 35.70 | 35.65 | 0.15 | 4.91 | 4.96 | -0.97 |
| | | | | 5725 | 35.26 | 35.39 | -0.37 | 5.20 | 5.19 | 0.13 |
| G | 3/13/2019 | 5600 | Body | 5600 | 47.86 | 48.48 | -1.27 | 5.86 | 5.76 | 1.70 |
| | | | | 5500 | 48.04 | 48.61 | -1.18 | 5.71 | 5.64 | 1.09 |
| | | | | 5725 | 47.59 | 48.31 | -1.49 | 6.06 | 5.91 | 2.58 |
| G | 3/13/2019 | 5750 | Head | 5750 | 35.22 | 35.36 | -0.40 | 5.23 | 5.21 | 0.39 |
| | | | | 5700 | 35.34 | 35.42 | -0.23 | 5.16 | 5.16 | -0.05 |
| | | | | 5850 | 35.06 | 35.30 | -0.68 | 5.34 | 5.27 | 1.29 |
| G | 3/13/2019 | 5750 | Body | 5750 | 47.56 | 48.27 | -1.48 | 6.10 | 5.94 | 2.83 |
| | | | | 5700 | 47.66 | 48.34 | -1.41 | 6.02 | 5.88 | 2.34 |
| | | | | 5850 | 47.38 | 48.20 | -1.70 | 6.24 | 6.00 | 4.03 |
| H | 2/26/2019 | 1900 | Head | 1900 | 38.04 | 40.00 | -4.90 | 1.39 | 1.40 | -0.71 |
| | | | | 1850 | 38.09 | 40.00 | -4.77 | 1.36 | 1.40 | -2.64 |
| | | | | 1920 | 38.04 | 40.00 | -4.90 | 1.40 | 1.40 | 0.07 |
| H | 2/26/2019 | 1900 | Body | 1900 | 51.72 | 53.30 | -2.96 | 1.53 | 1.52 | 0.79 |
| | | | | 1850 | 51.77 | 53.30 | -2.87 | 1.50 | 1.52 | -1.18 |
| | | | | 1920 | 51.72 | 53.30 | -2.96 | 1.55 | 1.52 | 1.64 |
| H | 3/11/2019 | 1900 | Head | 1900 | 41.00 | 40.00 | 2.50 | 1.45 | 1.40 | 3.50 |
| | | | | 1850 | 41.07 | 40.00 | 2.68 | 1.42 | 1.40 | 1.36 |
| | | | | 1920 | 40.99 | 40.00 | 2.48 | 1.47 | 1.40 | 4.64 |
| H | 3/11/2019 | 1900 | Body | 1900 | 55.78 | 53.30 | 4.65 | 1.51 | 1.52 | -0.99 |
| | | | | 1850 | 55.80 | 53.30 | 4.69 | 1.47 | 1.52 | -3.09 |
| | | | | 1920 | 55.76 | 53.30 | 4.62 | 1.52 | 1.52 | 0.00 |


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**Dielectric Property Measurements Results for Test Dates 3/20/2019 to 3/21/2019:**

| SAR Lab | Date | Band (MHz) | Tissue Type | Frequency (MHz) | Relative Permittivity (εr) | | | Conductivity (σ) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Measured | Target | Delta (%) | Measured | Target | Delta (%) |
| 4 | 3/20/2019 | 2600 | Body | 2600 | 50.59 | 52.51 | -3.66 | 2.17 | 2.16 | 0.38 |
| | | | | 2495 | 50.79 | 52.64 | -3.52 | 2.07 | 2.01 | 2.97 |
| | | | | 2690 | 50.46 | 52.40 | -3.70 | 2.25 | 2.29 | -1.50 |
| 4 | 3/21/2019 | 2600 | Head | 2600 | 40.76 | 39.01 | 4.48 | 1.94 | 1.96 | -1.33 |
| | | | | 2495 | 40.87 | 39.14 | 4.41 | 1.84 | 1.85 | -0.36 |
| | | | | 2690 | 40.58 | 38.90 | 4.33 | 2.01 | 2.06 | -2.30 |


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## 8.2. System 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 re-measured or sooner when marginal liquid parameters are used at the beginning of a series of measurements.

**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 for SAR measurements ≤ 3 GHz and ≥ 10.0 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.


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## System 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. Refer to Appendix B for the SAR

### System Check Plots for Test Dates 2/26/2019 to 3/15/2019:

| SAR Lab | Date | Tissue Type | Dipole Type _Serial # | Dipole Cal. Due Data | Measured Results for 1g SAR | | | | Measured Results for 10g SAR | | | | Plot No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Zoom Scan to 100 mW | Normalize to 1 W | Target (Ref. Value) | Delta ±10 % | Zoom Scan to 100 mW | Normalize to 1 W | Target (Ref. Value) | Delta ±10 % | |
| E | 3/11/2019 | Head | D5GHzV2 SN:1138 (5.6 GHz) | 8/21/2019 | 8.690 | 86.90 | 86.00 | 1.05 | 2.480 | 24.80 | 24.60 | 0.81 | |
| E | 3/11/2019 | Body | D5GHzV2 SN:1138 (5.6 GHz) | 8/21/2019 | 8.390 | 83.90 | 79.50 | **5.53** | 2.340 | 23.40 | 22.20 | 5.41 | 1,2 |
| F | 2/26/2018 | Head | D835V2 SN:4d142 | 8/23/2019 | 0.926 | 9.26 | 9.48 | -2.32 | 0.607 | 6.07 | 6.10 | -0.49 | |
| F | 2/26/2018 | Body | D835V2 SN:4d142 | 8/23/2019 | 0.911 | 9.11 | 9.68 | **-5.89** | 0.599 | 5.99 | 6.36 | -5.82 | 3,4 |
| F | 3/4/2019 | Head | D835V2 SN:4d117 | 5/16/2019 | 0.924 | 9.24 | 9.87 | -6.38 | 0.604 | 6.04 | 6.40 | -5.63 | |
| F | 3/4/2019 | Body | D835V2 SN:4d117 | 5/16/2019 | 0.965 | 9.65 | 10.31 | **-6.40** | 0.632 | 6.32 | 6.84 | -7.60 | 5,6 |
| F | 3/11/2019 | Body | D835V2 SN:4d142 | 8/23/2019 | 0.934 | 9.34 | 9.68 | -3.51 | 0.615 | 6.15 | 6.36 | -3.30 | |
| G | 2/26/2018 | Head | D2450V2 SN:899 | 3/16/2019 | 5.130 | 51.30 | 51.75 | -0.87 | 2.380 | 23.80 | 24.20 | -1.65 | |
| G | 2/26/2018 | Body | D2450V2 SN:899 | 3/16/2019 | 4.730 | 47.30 | 50.55 | **-6.43** | 2.170 | 21.70 | 23.20 | -6.47 | 7,8 |
| G | 3/4/2019 | Head | D2600V2 SN:1006 | 10/16/2019 | 5.500 | 55.00 | 59.31 | **-7.27** | 2.470 | 24.70 | 26.43 | -6.55 | 9,10 |
| G | 3/4/2019 | Body | D2600V2 SN:1006 | 10/16/2019 | 5.480 | 54.80 | 58.52 | -6.36 | 2.470 | 24.70 | 26.15 | -5.54 | |
| G | 3/13/2019 | Head | D5GHzV2 SN:1138 (5.25 GHz) | 8/21/2019 | 7.490 | 74.90 | 82.60 | **-9.32** | 2.160 | 21.60 | 23.80 | -9.24 | 11,12 |
| G | 3/13/2019 | Body | D5GHzV2 SN:1138 (5.25 GHz) | 8/21/2019 | 7.050 | 70.50 | 76.60 | -7.96 | 1.980 | 19.80 | 21.40 | -7.48 | |
| G | 3/13/2019 | Head | D5GHzV2 SN:1138 (5.6 GHz) | 8/21/2019 | 8.250 | 82.50 | 86.00 | **-4.07** | 2.350 | 23.50 | 24.60 | -4.47 | 13,14 |
| G | 3/13/2019 | Body | D5GHzV2 SN:1138 (5.6 GHz) | 8/21/2019 | 7.830 | 78.30 | 79.50 | -1.51 | 2.190 | 21.90 | 22.20 | -1.35 | |
| G | 3/13/2019 | Head | D5GHzV2 SN:1138 (5.75 GHz) | 8/21/2019 | 7.770 | 77.70 | 82.40 | **-5.70** | 2.250 | 22.50 | 23.60 | -4.66 | 15,16 |
| G | 3/13/2019 | Body | D5GHzV2 SN:1138 (5.75 GHz) | 8/21/2019 | 7.210 | 72.10 | 74.10 | -2.70 | 2.020 | 20.20 | 20.60 | -1.94 | |
| H | 2/26/2018 | Head | D1900V2 SN:5d140 | 4/11/2019 | 3.650 | 36.50 | 38.93 | -6.24 | 1.880 | 18.80 | 20.14 | -6.65 | |
| H | 2/26/2018 | Body | D1900V2 SN:5d140 | 4/11/2019 | 3.790 | 37.90 | 41.00 | **-7.56** | 1.970 | 19.70 | 21.05 | -6.41 | 17,18 |
| H | 3/11/2019 | Head | D1900V2 SN:5d140 | 4/11/2019 | 4.060 | 40.60 | 38.93 | 4.29 | 2.090 | 20.90 | 20.14 | 3.77 | |
| H | 3/11/2019 | Body | D1900V2 SN:5d140 | 4/11/2019 | 4.180 | 41.80 | 41.00 | 1.95 | 2.180 | 21.80 | 21.05 | 3.56 | |

### System Check Plots for Test Dates 3/20/2019 to 3/21/2019:

| SAR Lab | Date | Tissue Type | Dipole Type _Serial # | Dipole Cal. Due Data | Measured Results for 1g SAR | | | | Measured Results for 10g SAR | | | | Plot No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Zoom Scan to 100 mW | Normalize to 1 W | Target (Ref. Value) | Delta ±10 % | Zoom Scan to 100 mW | Normalize to 1 W | Target (Ref. Value) | Delta ±10 % | |
| 4 | 3/20/2019 | Body | D2600V2 SN:1006 | 10/16/2019 | 5.580 | 55.80 | 58.52 | **-4.65** | 2.460 | 24.60 | 26.15 | -5.93 | 19,20 |
| 4 | 3/21/2019 | Head | D2600V2 SN:1006 | 10/16/2019 | 5.840 | 58.40 | 59.31 | -1.53 | 2.600 | 26.00 | 26.43 | -1.63 | |


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# 9. Conducted Output Power Measurements

## 9.1. GSM

**Per KDB 941225 D01 3G SAR Procedures:**

SAR test reduction for GPRS and EDGE modes is determined by the source-based time-averaged output power specified for production units, including tune-up tolerance. The data mode with highest specified time-averaged output power should be tested for SAR compliance in the applicable exposure conditions. For modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested.

When different maximum output power applies to GSM voice or GPRS/EDGE time slots, GSM voice and GPRS/EDGE time slots should be tested separately to determine compliance by summing the corresponding reported SAR.

The GMSK EDGE configurations are grouped with GPRS and considered with respect to time-averaged maximum output power to determine compliance

**Per October 2013 TCB Workshop:**

When the maximum frame-averaged powers levels are within 0.25 dB of each other, test the configuration with the most number of time slots.

**Maximum Output Power (Tune-up Limit) for GSM**

SAR is not required for EDGE (8PSK) mode because the maximum output power and tune-up limit is ≤ 1/4dB higher than GPRS/EDGE (GMSK) or the adjusted SAR of the highest reported SAR of GPRS/EDGE (GMSK) is ≤ 1.2W/kg.

**GSM850 Measured Results**

| Mode | Coding Scheme | Time Slots | Ch No. | Freq. (MHz) | Maximum Average Power (dBm) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Measured | | Tune-up Limit | |
| | | | | | Burst Pwr | Frame Pwr | Burst Pwr | Frame Pwr |
| GPRS/EDGE (GMSK) | CS1 | 1 | 128 | 824.2 | 34.0 | 25.0 | 34.0 | 25.0 |
| | | | 190 | 836.6 | 34.0 | 25.0 | | |
| | | | 251 | 848.8 | 34.0 | 25.0 | | |
| | | 2 | 128 | 824.2 | 30.7 | 24.7 | 31.0 | 25.0 |
| | | | 190 | 836.6 | 30.2 | 24.2 | | |
| | | | 251 | 848.8 | 30.3 | 24.3 | | |
| | | 3 | 128 | 824.2 | 28.5 | 24.2 | 29.0 | 24.7 |
| | | | 190 | 836.6 | 28.5 | 24.3 | | |
| | | | 251 | 848.8 | 28.6 | 24.3 | | |
| | | 4 | 128 | 824.2 | 27.5 | 24.5 | 28.0 | **25.0** |
| | | | 190 | 836.6 | 27.3 | 24.3 | | |
| | | | 251 | 848.8 | 26.6 | 23.6 | | |
| EDGE (8PSK) | MCS5 | 1 | 128 | 824.2 | 26.4 | 17.4 | 27.5 | 18.5 |
| | | | 190 | 836.6 | 26.3 | 17.2 | | |
| | | | 251 | 848.8 | 26.0 | 17.0 | | |
| | | 2 | 128 | 824.2 | 24.0 | 18.0 | 25.0 | 19.0 |
| | | | 190 | 836.6 | 23.9 | 17.9 | | |
| | | | 251 | 848.8 | 23.8 | 17.7 | | |
| | | 3 | 128 | 824.2 | 22.7 | 18.5 | 23.5 | 19.2 |
| | | | 190 | 836.6 | 22.5 | 18.2 | | |
| | | | 251 | 848.8 | 22.3 | 18.0 | | |
| | | 4 | 128 | 824.2 | 21.2 | 18.2 | 22.0 | 19.0 |
| | | | 190 | 836.6 | 21.0 | 18.0 | | |
| | | | 251 | 848.8 | 20.8 | 17.8 | | |

**Notes:**

GPRS/EDGE (GMSK) mode with 4 time slots for Max power, based on the Tune-up Procedure.



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## GSM1900 Measured Results

| Mode | Coding Scheme | Time Slots | Ch No. | Freq. (MHz) | Maximum Average Power (dBm) | | | | Hotspot Reduced Average Power (dBm) | | | | Grip Sensor Reduced Average Power (dBm) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Measured | | Tune-up Limit | | Measured | | Tune-up Limit | | Measured | | Tune-up Limit | |
| | | | | | Burst Pwr | Frame Pwr | Burst Pwr | Frame Pwr | Burst Pwr | Frame Pwr | Burst Pwr | Frame Pwr | Burst Pwr | Frame Pwr | Burst Pwr | Frame Pwr |
| GPRS/EDGE (GMSK) | CS1 | 1 | 512 | 1850.2 | 29.6 | 20.6 | 31.0 | 22.0 | 27.4 | 18.4 | 29.0 | 20.0 | 26.5 | 17.5 | 28.0 | 19.0 |
| | | | 661 | 1880.0 | 29.3 | 20.3 | | | 27.4 | 18.3 | | | 26.4 | 17.4 | | |
| | | | 810 | 1909.8 | 29.7 | 20.6 | | | 27.7 | 18.6 | | | 26.7 | 17.7 | | |
| | | 2 | 512 | 1850.2 | 27.7 | 21.7 | 28.0 | 22.0 | 25.7 | 19.7 | 26.0 | 20.0 | 24.8 | 18.8 | 25.0 | 19.0 |
| | | | 661 | 1880.0 | 27.4 | 21.4 | | | 25.6 | 19.6 | | | 24.6 | 18.6 | | |
| | | | 810 | 1909.8 | 27.8 | 21.7 | | | 25.9 | 19.9 | | | 24.9 | 18.9 | | |
| | | 3 | 512 | 1850.2 | 25.6 | 21.4 | 26.0 | 21.7 | 23.5 | 19.3 | 24.0 | 19.7 | 22.5 | 18.2 | 23.0 | 18.7 |
| | | | 661 | 1880.0 | 25.1 | 20.9 | | | 23.4 | 19.1 | | | 22.5 | 18.2 | | |
| | | | 810 | 1909.8 | 25.5 | 21.2 | | | 23.7 | 19.4 | | | 22.8 | 18.5 | | |
| | | 4 | 512 | 1850.2 | 24.7 | 21.7 | 25.0 | **22.0** | 22.8 | 19.8 | 23.0 | **20.0** | 22.0 | 19.0 | 22.0 | **19.0** |
| | | | 661 | 1880.0 | 24.4 | 21.4 | | | 23.0 | 20.0 | | | 21.8 | 18.8 | | |
| | | | 810 | 1909.8 | 24.7 | 21.7 | | | 23.0 | 20.0 | | | 22.0 | 19.0 | | |
| EDGE (8PSK) | MCS5 | 1 | 512 | 1850.2 | 25.3 | 16.2 | 26.0 | 17.0 | 23.2 | 14.2 | 24.0 | 15.0 | 22.5 | 13.5 | 23.0 | 14.0 |
| | | | 661 | 1880.0 | 24.9 | 15.8 | | | 23.1 | 14.0 | | | 22.2 | 13.2 | | |
| | | | 810 | 1909.8 | 25.2 | 16.2 | | | 23.5 | 14.4 | | | 22.6 | 13.6 | | |
| | | 2 | 512 | 1850.2 | 23.1 | 17.1 | 23.5 | 17.5 | 21.1 | 15.0 | 21.5 | 15.5 | 20.2 | 14.2 | 20.5 | 14.5 |
| | | | 661 | 1880.0 | 22.7 | 16.7 | | | 21.0 | 14.9 | | | 20.0 | 14.0 | | |
| | | | 810 | 1909.8 | 23.2 | 17.2 | | | 21.4 | 15.4 | | | 20.4 | 14.4 | | |
| | | 3 | 512 | 1850.2 | 22.5 | 18.2 | 23.0 | 18.7 | 20.4 | 16.2 | 21.0 | 16.7 | 19.5 | 15.2 | 20.0 | 15.7 |
| | | | 661 | 1880.0 | 22.1 | 17.8 | | | 20.0 | 15.8 | | | 19.4 | 15.1 | | |
| | | | 810 | 1909.8 | 22.5 | 18.2 | | | 20.8 | 16.5 | | | 19.9 | 15.6 | | |
| | | 4 | 512 | 1850.2 | 20.7 | 17.6 | 21.0 | 18.0 | 18.7 | 15.6 | 19.0 | 16.0 | 17.8 | 14.8 | 18.0 | 15.0 |
| | | | 661 | 1880.0 | 20.4 | 17.3 | | | 18.6 | 15.6 | | | 17.7 | 14.7 | | |
| | | | 810 | 1909.8 | 20.9 | 17.8 | | | 19.0 | 16.0 | | | 18.0 | 15.0 | | |

**Notes:**

- GPRS/EDGE (GMSK) mode with 4 time slots for Max power, 4 time slots for Hotspot Reduced Power, and 4 time slots for Grip Sensor Reduced power, based on the Tune-up Procedure.


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## 9.2. W-CDMA

**Per KDB 941225 D01 3G SAR Procedures for W-CDMA:**

Maximum output power is verified on the high, middle and low channels and using the appropriate 12.2 kbps RMC with TPC (transmit power control) set to all “1’s”

**Release 99 Setup Procedures used to establish the test signals**

The following tests were completed according to the test requirements outlined in section 5.2 of the 3GPP TS34.121-1. A summary of these settings is illustrated below:

| Mode | Subtest | Rel99 |
|---|---|---|
| WCDMA General Settings | Loopback Mode | Test Mode 2 |
| | Rel99 RMC | 12.2kbps RMC |
| | Power Control Algorithm | Algorithm2 |
| | βc/βd | 8/15 |

**HSDPA Setup Procedures used to establish the test signals**

The following 4 Sub-tests were completed according to procedures in table C.10.1.4 of 3GPP TS 34.121-1
A summary of these settings is illustrated below:

**Table C.10.1.4: β values for transmitter characteristics tests with HS-DPCCH**

| Sub-test | $\beta_c$ | $\beta_d$ | $\beta_d$ (SF) | $\beta_c/\beta_d$ | $\beta_{hs}$ (Note 1, Note 2) | CM (dB) (Note 3) | MPR (dB) (Note 3) |
|---|---|---|---|---|---|---|---|
| 1 | 2/15 | 15/15 | 64 | 2/15 | 4/15 | 0.0 | 0.0 |
| 2 | 12/15 (Note 4) | 15/15 (Note 4) | 64 | 12/15 (Note 4) | 24/15 | 1.0 | 0.0 |
| 3 | 15/15 | 8/15 | 64 | 15/8 | 30/15 | 1.5 | 0.5 |
| 4 | 15/15 | 4/15 | 64 | 15/4 | 30/15 | 1.5 | 0.5 |

Note 1: $\Delta_{ACK}$, $\Delta_{NACK}$ and $\Delta_{CQI}$ = 30/15 with $\beta_{hs}$ = 30/15 * $\beta_c$.

Note 2: For the HS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude (EVM) with HS-DPCCH test in clause 5.13.1A, and HSDPA EVM with phase discontinuity in clause 5.13.1AA, $\Delta_{ACK}$ and $\Delta_{NACK}$ = 30/15 with $\beta_{hs}$ = 30/15 * $\beta_c$, and $\Delta_{CQI}$ = 24/15 with $\beta_{hs}$ = 24/15 * $\beta_c$.

Note 3: CM = 1 for $\beta_c/\beta_d$ =12/15, $\beta_{hs}/\beta_c$=24/15. For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.

Note 4: For subtest 2 the $\beta_c/\beta_d$ ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to $\beta_c$ = 11/15 and $\beta_d$ = 15/15.

**HSUPA Setup Procedures used to establish the test signals**

The following 5 Sub-tests were completed according to procedures in table C.11.1.3 of 3GPP TS 34.121-1. A summary of these settings is illustrated below:

**Table C.11.1.3: β values for transmitter characteristics tests with HS-DPCCH and E-DCH**

| Sub-test | $\beta_c$ | $\beta_d$ | $\beta_d$ (SF) | $\beta_c/\beta_d$ | $\beta_{hs}$ (Note 1) | $\beta_{ec}$ | $\beta_{ed}$ (Note 4) (Note 5) | $\beta_{ed}$ (SF) | $\beta_{ed}$ (Codes) | CM (dB) (Note 2) | MPR (dB) (Note 2) (Note 6) | AG Index (Note 5) | E-TFCI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 11/15 (Note 3) | 15/15 (Note 3) | 64 | 11/15 (Note 3) | 22/15 | 209/225 | 1309/225 | 4 | 1 | 1.0 | 0.0 | 20 | 75 |
| 2 | 6/15 | 15/15 | 64 | 6/15 | 12/15 | 12/15 | 94/75 | 4 | 1 | 3.0 | 2.0 | 12 | 67 |
| 3 | 15/15 | 9/15 | 64 | 15/9 | 30/15 | 30/15 | $\beta_{ed}1$: 47/15<br>$\beta_{ed}2$: 47/15 | 4<br>4 | 2 | 2.0 | 1.0 | 15 | 92 |
| 4 | 2/15 | 15/15 | 64 | 2/15 | 4/15 | 2/15 | 56/75 | 4 | 1 | 3.0 | 2.0 | 17 | 71 |
| 5 | 15/15 | 0 | - | - | 5/15 | 5/15 | 47/15 | 4 | 1 | 1.0 | 0.0 | 12 | 67 |

Note 1: For sub-test 1 to 4, $\Delta_{ACK}$, $\Delta_{NACK}$ and $\Delta_{CQI}$ = 30/15 with $\beta_{hs}$ = 30/15 * $\beta_c$. For sub-test 5, $\Delta_{ACK}$, $\Delta_{NACK}$ and $\Delta_{CQI}$ = 5/15 with $\beta_{hs}$ = 5/15 * $\beta_c$.

Note 2: CM = 1 for $\beta_c/\beta_d$ =12/15, $\beta_{hs}/\beta_c$=24/15. For all other combinations of DPDCH, DPCCH, HS- DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.

Note 3: For subtest 1 the $\beta_c/\beta_d$ ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to $\beta_c$ = 10/15 and $\beta_d$ = 15/15.

Note 4: In case of testing by UE using E-DPDCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g.

Note 5: $\beta_{ed}$ can not be set directly; it is set by Absolute Grant Value.

Note 6: For subtests 2, 3 and 4, UE may perform E-DPDCH power scaling at max power which could results in slightly smaller MPR values.


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**DC-HSDPA Setup Procedures used to establish the test signals**

The following 4 Sub-tests for DC-HSDPA were completed according to procedures in table C08.1.12 of 3GPP TS 34.121-1. A summary of subtest settings is illustrated below:

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

| Parameter | Unit | Value |
|---|---|---|
| Nominal Avg. Inf. Bit Rate | kbps | 60 |
| Inter-TTI Distance | TTI's | 1 |
| Number of HARQ Processes | Processes | 6 |
| Information Bit Payload ( $N_{INF}$ ) | Bits | 120 |
| Number Code Blocks | Blocks | 1 |
| Binary Channel Bits Per TTI | Bits | 960 |
| Total Available SML's in UE | SML's | 19200 |
| Number of SML's per HARQ Proc. | SML's | 3200 |
| Coding Rate | | 0.15 |
| Number of Physical Channel Codes | Codes | 1 |
| Modulation | | QPSK |

Note 1: The RMC is intended to be used for DC-HSDPA mode and both cells shall transmit with identical parameters as listed in the table.

Note 2: Maximum number of transmission is limited to 1, i.e., retransmission is not allowed. The redundancy and constellation version 0 shall be used.

**HSPA+**

DUT supports HSPA+ DL only. Therefore, conducted power measurements is not required.

SAR measurement is not required for the HSDPA, HSUPA and HSPA+. When primary mode and the adjusted SAR is ≤ 1.2 W/kg and secondary mode is ≤ ¼ dB higher than the primary mode



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## W-CDMA Band II Measured Results

| Mode | | UL Ch No. | Freq. (MHz) | Maximum Average Power (dBm) | | | Hotspot Reduced Average Power (dBm) | | | Grip Sensor Reduced Average Power (dBm) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Measured Pwr | MPR | Tune-up Limit | Measured Pwr | MPR | Tune-up Limit | Measured Pwr | MPR | Tune-up Limit |
| Release 99 | Rel 99 (RMC, 12.2 kbps) | 9262 | 1852.4 | 24.8 | N/A | 25.0 | 22.2 | N/A | 23.0 | 21.4 | N/A | 22.0 |
| | | 9400 | 1880.0 | 24.3 | | | 22.1 | | | 21.2 | | |
| | | 9538 | 1907.6 | 24.4 | | | 22.3 | | | 21.3 | | |
| HSDPA | Subtest 1 | 9262 | 1852.4 | 23.8 | 0.0 | 24.0 | 21.2 | 0.0 | 22.0 | 19.8 | 0.0 | 21.0 |
| | | 9400 | 1880.0 | 23.4 | | | 21.0 | | | 19.5 | | |
| | | 9538 | 1907.6 | 23.3 | | | 21.2 | | | 19.7 | | |
| | Subtest 2 | 9262 | 1852.4 | 23.9 | 0.0 | 24.0 | 21.3 | 0.0 | 22.0 | 19.3 | 0.0 | 21.0 |
| | | 9400 | 1880.0 | 23.4 | | | 21.0 | | | 19.1 | | |
| | | 9538 | 1907.6 | 23.4 | | | 21.1 | | | 19.2 | | |
| | Subtest 3 | 9262 | 1852.4 | 23.3 | 0.5 | 23.5 | 20.7 | 0.5 | 21.5 | 18.6 | 0.5 | 20.5 |
| | | 9400 | 1880.0 | 22.9 | | | 20.7 | | | 18.5 | | |
| | | 9538 | 1907.6 | 22.9 | | | 20.7 | | | 18.6 | | |
| | Subtest 4 | 9262 | 1852.4 | 23.1 | 0.5 | 23.5 | 20.7 | 0.5 | 21.5 | 18.6 | 0.5 | 20.5 |
| | | 9400 | 1880.0 | 23.0 | | | 20.9 | | | 18.2 | | |
| | | 9538 | 1907.6 | 22.9 | | | 20.7 | | | 18.4 | | |
| HSUPA | Subtest 1 | 9262 | 1852.4 | 23.9 | 0.0 | 24.0 | 21.2 | 0.0 | 22.0 | 19.8 | 0.0 | 21.0 |
| | | 9400 | 1880.0 | 23.4 | | | 21.0 | | | 19.7 | | |
| | | 9538 | 1907.6 | 23.4 | | | 21.3 | | | 19.8 | | |
| | Subtest 2 | 9262 | 1852.4 | 21.9 | 2.0 | 22.0 | 19.3 | 2.0 | 20.0 | 17.9 | 2.0 | 19.0 |
| | | 9400 | 1880.0 | 21.4 | | | 19.2 | | | 17.6 | | |
| | | 9538 | 1907.6 | 21.5 | | | 19.3 | | | 17.8 | | |
| | Subtest 3 | 9262 | 1852.4 | 22.9 | 1.0 | 23.0 | 20.3 | 1.0 | 21.0 | 18.9 | 1.0 | 20.0 |
| | | 9400 | 1880.0 | 22.3 | | | 20.1 | | | 18.6 | | |
| | | 9538 | 1907.6 | 22.5 | | | 20.2 | | | 18.8 | | |
| | Subtest 4 | 9262 | 1852.4 | 21.8 | 2.0 | 22.0 | 19.3 | 2.0 | 20.0 | 17.8 | 2.0 | 19.0 |
| | | 9400 | 1880.0 | 21.4 | | | 19.1 | | | 17.6 | | |
| | | 9538 | 1907.6 | 21.4 | | | 19.1 | | | 17.8 | | |
| | Subtest 5 | 9262 | 1852.4 | 23.8 | 0.0 | 24.0 | 21.3 | 0.0 | 22.0 | 19.9 | 0.0 | 21.0 |
| | | 9400 | 1880.0 | 23.3 | | | 21.1 | | | 19.7 | | |
| | | 9538 | 1907.6 | 23.3 | | | 21.3 | | | 19.8 | | |
| DC-HSDPA | Subtest 1 | 9262 | 1852.4 | 22.9 | 0.0 | 24.0 | 20.9 | 0.0 | 22.0 | 19.9 | 0.0 | 21.0 |
| | | 9400 | 1880.0 | 22.7 | | | 20.7 | | | 19.7 | | |
| | | 9538 | 1907.6 | 22.8 | | | 20.8 | | | 19.8 | | |
| | Subtest 2 | 9262 | 1852.4 | 22.9 | 0.0 | 24.0 | 20.9 | 0.0 | 22.0 | 19.9 | 0.0 | 21.0 |
| | | 9400 | 1880.0 | 22.6 | | | 20.7 | | | 19.7 | | |
| | | 9538 | 1907.6 | 22.9 | | | 20.9 | | | 19.9 | | |
| | Subtest 3 | 9262 | 1852.4 | 22.4 | 0.5 | 23.5 | 20.4 | 0.5 | 21.5 | 19.4 | 0.5 | 20.5 |
| | | 9400 | 1880.0 | 22.2 | | | 20.2 | | | 19.2 | | |
| | | 9538 | 1907.6 | 22.3 | | | 20.3 | | | 19.4 | | |
| | Subtest 4 | 9262 | 1852.4 | 22.4 | 0.5 | 23.5 | 20.4 | 0.5 | 21.5 | 19.4 | 0.5 | 20.5 |
| | | 9400 | 1880.0 | 22.2 | | | 20.2 | | | 19.2 | | |
| | | 9538 | 1907.6 | 22.3 | | | 20.4 | | | 19.4 | | |


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**W-CDMA Band V Measured Results**

| Mode | | UL Ch No. | Freq. (MHz) | Maximum Average Power (dBm) | | |
|---|---|---|---|---|---|---|
| | | | | Measured Pwr | MPR | Tune-up Limit |
| Release 99 | Rel 99 (RMC, 12.2 kbps) | 4132 | 826.4 | 23.4 | N/A | 25.0 |
| | | 4183 | 836.6 | 23.2 | | |
| | | 4233 | 846.6 | 23.1 | | |
| HSDPA | Subtest 1 | 4132 | 826.4 | 22.3 | 0.0 | 24.0 |
| | | 4183 | 836.6 | 22.2 | | |
| | | 4233 | 846.6 | 22.1 | | |
| | Subtest 2 | 4132 | 826.4 | 22.3 | 0.0 | 24.0 |
| | | 4183 | 836.6 | 22.3 | | |
| | | 4233 | 846.6 | 22.1 | | |
| | Subtest 3 | 4132 | 826.4 | 22.4 | 0.5 | 23.5 |
| | | 4183 | 836.6 | 22.2 | | |
| | | 4233 | 846.6 | 22.1 | | |
| | Subtest 4 | 4132 | 826.4 | 22.4 | 0.5 | 23.5 |
| | | 4183 | 836.6 | 22.1 | | |
| | | 4233 | 846.6 | 22.0 | | |
| HSUPA | Subtest 1 | 4132 | 826.4 | 22.4 | 0.0 | 24.0 |
| | | 4183 | 836.6 | 22.2 | | |
| | | 4233 | 846.6 | 22.1 | | |
| | Subtest 2 | 4132 | 826.4 | 20.9 | 2.0 | 22.0 |
| | | 4183 | 836.6 | 20.7 | | |
| | | 4233 | 846.6 | 20.5 | | |
| | Subtest 3 | 4132 | 826.4 | 21.4 | 1.0 | 23.0 |
| | | 4183 | 836.6 | 21.1 | | |
| | | 4233 | 846.6 | 21.1 | | |
| | Subtest 4 | 4132 | 826.4 | 21.7 | 2.0 | 22.0 |
| | | 4183 | 836.6 | 21.6 | | |
| | | 4233 | 846.6 | 21.7 | | |
| | Subtest 5 | 4132 | 826.4 | 22.4 | 0.0 | 24.0 |
| | | 4183 | 836.6 | 22.2 | | |
| | | 4233 | 846.6 | 22.0 | | |
| DC-HSDPA | Subtest 1 | 4132 | 826.4 | 23.7 | 0.0 | 24.0 |
| | | 4183 | 836.6 | 23.5 | | |
| | | 4233 | 846.6 | 23.3 | | |
| | Subtest 2 | 4132 | 826.4 | 23.7 | 0.0 | 24.0 |
| | | 4183 | 836.6 | 23.5 | | |
| | | 4233 | 846.6 | 23.3 | | |
| | Subtest 3 | 4132 | 826.4 | 23.2 | 0.5 | 23.5 |
| | | 4183 | 836.6 | 23.0 | | |
| | | 4233 | 846.6 | 22.8 | | |
| | Subtest 4 | 4132 | 826.4 | 23.2 | 0.5 | 23.5 |
| | | 4183 | 836.6 | 22.6 | | |
| | | 4233 | 846.6 | 22.6 | | |


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## 9.3. CDMA

**1x Advanced Setup Procedures used to establish the test signals**

Call box setup procedure

- Protocol Rev > 6 (IS-2000-0)
- System ID: 331; NID: 65535, Reg. Ch. #.:
- Radio Config (RC) > Fwd11, Rvs8
- Service Option (SO) Setup > SO75 (Loopback)
- Traffic Data Rate > Full
- Rvs Power Ctrl > All Up bits (Maximum Tx Pout)
- Reverse Power Control Mode: 00-200 to 400 bps
- Smart blanking was disabled.

**Maximum Output Power (Tune-up Limit) for CDMA**

SAR for next to the ear head exposure is measured in RC3 with the handset configured to transmit at full rate in SO55. The 3G SAR test reduction procedure is applied to RC1 with RC3 as the primary mode

Body-worn accessory SAR is measured in RC3 with the handset configured in TDSO/SO32 to transmit at full rate on FCH only with all other code channels disabled. The body-worn accessory procedures in KDB Publication 447498 D01 are applied. The 3G SAR test reduction procedure is applied to the multiple code channel configuration (FCH+SCHn), with FCH only as the primary mode.

When VOIP is supported by Ev-Do devices for next to the ear use, head exposure SAR is required.

SAR measurement is not required for the 1xEVDO Rev. A and 1x-Advanced. When primary mode and the adjusted SAR is ≤ 1.2 W/kg and secondary mode is ≤ ¼ dB higher than the primary mode

**CDMA BC0 Measured Results**

| Mode | | Channel | Freq. (MHz) | Maximum Average Power (dBm) | |
|---|---|---|---|---|---|
| | | | | Measured Pwr | Tune-up Limit |
| 1xRTT | RC1, SO55 (Loopback) | 1013 | 824.70 | 25.3 | 26.0 |
| | | 384 | 836.52 | 25.1 | |
| | | 777 | 848.31 | 24.8 | |
| | RC3, SO55 (Loopback) | 1013 | 824.70 | 25.3 | |
| | | 384 | 836.52 | 25.2 | |
| | | 777 | 848.31 | 24.8 | |
| | RC3, SO32 (+F-SCH) | 1013 | 824.70 | 25.3 | |
| | | 384 | 836.52 | 25.1 | |
| | | 777 | 848.31 | 24.8 | |
| 1xAdvanced | Fwd11/Rvs8 SO75 (Loopback) | 1013 | 824.70 | 25.3 | 26.0 |
| | | 384 | 836.52 | 25.1 | |
| | | 777 | 848.31 | 24.8 | |
| 1xEv-Do Rel. 0 | 307.2 kbps (2 slot, QPSK) | 1013 | 824.70 | 25.3 | 26.0 |
| | | 384 | 836.52 | 25.2 | |
| | | 777 | 848.31 | 24.9 | |
| 1xEv-Do Rev. A | 307.2k, QPSK/ ACK channel is transmitted at all the slots | 1013 | 824.70 | 25.3 | 26.0 |
| | | 384 | 836.52 | 25.1 | |
| | | 777 | 848.31 | 24.7 | |


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## 9.4. LTE

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

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

**Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 1, 2 and 3**

| Modulation | Channel bandwidth / Transmission bandwidth ($N_{RB}$) | | | | | | 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 |
| 64 QAM | ≤ 5 | ≤ 4 | ≤ 8 | ≤ 12 | ≤ 16 | ≤ 18 | ≤ 2 |
| 64 QAM | > 5 | > 4 | > 8 | > 12 | > 16 | > 18 | ≤ 3 |
| 256 QAM | ≥ 1 | | | | | | ≤ 5 |

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

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

| Network Signalling value | Requirements (subclause) | 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 | N/A |

LTE QPSK configuration has the highest maximum average output power per 3GPP standard.

SAR measurement is not required for the 16QAM and 64QAM. When the highest maximum output power for 16QAM and 64QAM is ≤ ½ dB higher than the QPSK or when the reported SAR for the QPSK configuration is ≤ 1.45 W/kg.

Please refer to section 6.3. for LTE detail test channels.


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## LTE Band 5 Measured Results

| BW (MHz) | Mode | RB Allocation | RB offset | Maximum Average Power (dBm) | | | MPR | Tune-up Limit |
|---|---|---|---|---|---|---|---|---|
| | | | | [redacted] | 20525 | [redacted] | | |
| | | | | | 836.5 MHz | | | |
| 10 MHz | QPSK | 1 | 0 | | 23.7 | | 0.0 | 25.0 |
| | | 1 | 25 | | 23.6 | | 0.0 | 25.0 |
| | | 1 | 49 | | 23.6 | | 0.0 | 25.0 |
| | | 25 | 0 | | 22.8 | | 1.0 | 24.0 |
| | | 25 | 12 | | 22.8 | | 1.0 | 24.0 |
| | | 25 | 25 | | 22.7 | | 1.0 | 24.0 |
| | | 50 | 0 | | 22.7 | | 1.0 | 24.0 |
| | 16QAM | 1 | 0 | | 22.6 | | 1.0 | 24.0 |
| | | 1 | 25 | | 22.6 | | 1.0 | 24.0 |
| | | 1 | 49 | | 22.5 | | 1.0 | 24.0 |
| | | 25 | 0 | | 21.8 | | 2.0 | 23.0 |
| | | 25 | 12 | | 21.8 | | 2.0 | 23.0 |
| | | 25 | 25 | | 21.8 | | 2.0 | 23.0 |
| | | 50 | 0 | | 21.8 | | 2.0 | 23.0 |
| | 64QAM | 1 | 0 | | 22.0 | | 2.0 | 23.0 |
| | | 1 | 25 | | 22.0 | | 2.0 | 23.0 |
| | | 1 | 49 | | 22.0 | | 2.0 | 23.0 |
| | | 25 | 0 | | 20.8 | | 3.0 | 22.0 |
| | | 25 | 12 | | 20.9 | | 3.0 | 22.0 |
| | | 25 | 25 | | 20.9 | | 3.0 | 22.0 |
| | | 50 | 0 | | 20.8 | | 3.0 | 22.0 |

| BW (MHz) | Mode | RB Allocation | RB offset | Maximum Average Power (dBm) | | | MPR | Tune-up Limit |
|---|---|---|---|---|---|---|---|---|
| | | | | 20425.0 | 20525.0 | 20625.0 | | |
| | | | | 826.5 MHz | 836.5 MHz | 846.5 MHz | | |
| 5 MHz | QPSK | 1 | 0 | 23.8 | 23.7 | 23.8 | 0.0 | 25.0 |
| | | 1 | 12 | 23.8 | 23.6 | 23.7 | 0.0 | 25.0 |
| | | 1 | 24 | 23.7 | 23.7 | 23.6 | 0.0 | 25.0 |
| | | 12 | 0 | 22.8 | 22.7 | 22.7 | 1.0 | 24.0 |
| | | 12 | 7 | 22.8 | 22.7 | 22.6 | 1.0 | 24.0 |
| | | 12 | 13 | 22.8 | 22.7 | 22.6 | 1.0 | 24.0 |
| | | 25 | 0 | 22.8 | 22.8 | 22.7 | 1.0 | 24.0 |
| | 16QAM | 1 | 0 | 22.9 | 23.2 | 22.8 | 1.0 | 24.0 |
| | | 1 | 12 | 22.8 | 23.1 | 22.7 | 1.0 | 24.0 |
| | | 1 | 24 | 22.8 | 23.2 | 22.7 | 1.0 | 24.0 |
| | | 12 | 0 | 21.9 | 21.9 | 21.8 | 2.0 | 23.0 |
| | | 12 | 7 | 21.9 | 21.9 | 21.7 | 2.0 | 23.0 |
| | | 12 | 13 | 21.9 | 21.9 | 21.7 | 2.0 | 23.0 |
| | | 25 | 0 | 21.8 | 21.8 | 21.7 | 2.0 | 23.0 |
| | 64QAM | 1 | 0 | 22.1 | 21.7 | 21.9 | 2.0 | 23.0 |
| | | 1 | 12 | 22.0 | 21.6 | 21.8 | 2.0 | 23.0 |
| | | 1 | 24 | 22.0 | 21.6 | 21.8 | 2.0 | 23.0 |
| | | 12 | 0 | 20.9 | 20.8 | 20.8 | 3.0 | 22.0 |
| | | 12 | 7 | 20.8 | 20.8 | 20.8 | 3.0 | 22.0 |
| | | 12 | 13 | 20.8 | 20.8 | 20.8 | 3.0 | 22.0 |
| | | 25 | 0 | 20.8 | 20.8 | 20.7 | 3.0 | 22.0 |

| BW (MHz) | Mode | RB Allocation | RB offset | Maximum Average Power (dBm) | | | MPR | Tune-up Limit |
|---|---|---|---|---|---|---|---|---|
| | | | | 20415.0 | 20525.0 | 20635.0 | | |
| | | | | 825.5 MHz | 836.5 MHz | 847.5 MHz | | |
| 3 MHz | QPSK | 1 | 0 | 23.8 | 23.6 | 23.6 | 0.0 | 25.0 |
| | | 1 | 8 | 23.8 | 23.7 | 23.7 | 0.0 | 25.0 |
| | | 1 | 14 | 23.7 | 23.6 | 23.5 | 0.0 | 25.0 |
| | | 8 | 0 | 22.8 | 22.7 | 22.6 | 1.0 | 24.0 |
| | | 8 | 4 | 22.8 | 22.7 | 22.6 | 1.0 | 24.0 |
| | | 8 | 7 | 22.8 | 22.7 | 22.6 | 1.0 | 24.0 |
| | | 15 | 0 | 22.8 | 22.7 | 22.6 | 1.0 | 24.0 |
| | 16QAM | 1 | 0 | 22.7 | 22.7 | 22.9 | 1.0 | 24.0 |
| | | 1 | 8 | 22.7 | 22.8 | 22.9 | 1.0 | 24.0 |
| | | 1 | 14 | 22.6 | 22.7 | 22.9 | 1.0 | 24.0 |
| | | 8 | 0 | 21.9 | 21.8 | 21.7 | 2.0 | 23.0 |
| | | 8 | 4 | 22.0 | 21.8 | 21.7 | 2.0 | 23.0 |
| | | 8 | 7 | 22.0 | 21.8 | 21.7 | 2.0 | 23.0 |
| | | 15 | 0 | 21.9 | 21.7 | 21.7 | 2.0 | 23.0 |
| | 64QAM | 1 | 0 | 21.9 | 22.0 | 21.8 | 2.0 | 23.0 |
| | | 1 | 8 | 22.0 | 22.1 | 21.8 | 2.0 | 23.0 |
| | | 1 | 14 | 21.9 | 22.0 | 21.7 | 2.0 | 23.0 |
| | | 8 | 0 | 20.9 | 20.8 | 20.6 | 3.0 | 22.0 |
| | | 8 | 4 | 20.9 | 20.9 | 20.6 | 3.0 | 22.0 |
| | | 8 | 7 | 20.9 | 20.9 | 20.6 | 3.0 | 22.0 |
| | | 15 | 0 | 20.9 | 20.8 | 20.7 | 3.0 | 22.0 |


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## LTE Band 5 Measured Results (continued)

| BW (MHz) | Mode | RB Allocation | RB offset | Maximum Average Power (dBm) | | | MPR | Tune-up Limit |
|---|---|---|---|---|---|---|---|---|
| | | | | 20407.0 | 20525.0 | 20643.0 | | |
| | | | | 824.7 MHz | 836.5 MHz | 848.3 MHz | | |
| 1.4 MHz | QPSK | 1 | 0 | 23.6 | 23.6 | 23.5 | 0.0 | 25.0 |
| | | 1 | 3 | 23.7 | 23.6 | 23.5 | 0.0 | 25.0 |
| | | 1 | 5 | 23.6 | 23.6 | 23.5 | 0.0 | 25.0 |
| | | 3 | 0 | 23.6 | 23.6 | 23.4 | 0.0 | 25.0 |
| | | 3 | 1 | 23.7 | 23.6 | 23.4 | 0.0 | 25.0 |
| | | 3 | 3 | 23.7 | 23.6 | 23.4 | 0.0 | 25.0 |
| | | 6 | 0 | 22.8 | 22.6 | 22.6 | 1.0 | 24.0 |
| | 16QAM | 1 | 0 | 22.7 | 22.9 | 22.5 | 1.0 | 24.0 |
| | | 1 | 3 | 22.7 | 23.0 | 22.6 | 1.0 | 24.0 |
| | | 1 | 5 | 22.7 | 23.0 | 22.5 | 1.0 | 24.0 |
| | | 3 | 0 | 22.8 | 22.8 | 22.5 | 1.0 | 24.0 |
| | | 3 | 1 | 22.9 | 22.8 | 22.5 | 1.0 | 24.0 |
| | | 3 | 3 | 22.9 | 22.8 | 22.5 | 1.0 | 24.0 |
| | | 6 | 0 | 21.9 | 21.6 | 21.7 | 2.0 | 23.0 |
| | 64QAM | 1 | 0 | 21.9 | 21.8 | 21.9 | 2.0 | 23.0 |
| | | 1 | 3 | 21.9 | 21.9 | 22.0 | 2.0 | 23.0 |
| | | 1 | 5 | 21.9 | 21.7 | 21.8 | 2.0 | 23.0 |
| | | 3 | 0 | 21.7 | 21.7 | 21.8 | 2.0 | 23.0 |
| | | 3 | 1 | 21.7 | 21.8 | 21.8 | 2.0 | 23.0 |
| | | 3 | 3 | 21.7 | 21.8 | 21.8 | 2.0 | 23.0 |
| | | 6 | 0 | 20.9 | 21.0 | 20.6 | 3.0 | 22.0 |


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## LTE Band 41 Measured Results

| BW (MHz) | Mode | RB Allocation | RB offset | Maximum Average Power (dBm) | | | | | Grip Sensor Reduced Average Power (dBm) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 40340 | 40740 | 41140 | MPR | Tune-up Limit | 40340 | 40740 | 41140 | MPR | Tune-up Limit |
| | | | | 2565 MHz | 2605 MHz | 2645 MHz | | | 2565 MHz | 2605 MHz | 2645 MHz | | |
| 20 MHz | QPSK | 1 | 0 | 23.8 | 23.9 | 23.8 | 0.0 | 24.5 | 21.3 | 21.5 | 21.2 | 0.0 | 22.5 |
| | | 1 | 49 | 23.8 | 23.9 | 23.8 | 0.0 | 24.5 | 21.3 | 21.5 | 21.1 | 0.0 | 22.5 |
| | | 1 | 99 | 23.8 | 23.8 | 23.6 | 0.0 | 24.5 | 21.3 | 21.3 | 21.0 | 0.0 | 22.5 |
| | | 50 | 0 | 22.8 | 22.9 | 22.8 | 1.0 | 23.5 | 21.4 | 21.5 | 21.2 | 0.0 | 22.5 |
| | | 50 | 24 | 22.9 | 22.9 | 22.8 | 1.0 | 23.5 | 21.4 | 21.5 | 21.3 | 0.0 | 22.5 |
| | | 50 | 50 | 22.8 | 22.9 | 22.8 | 1.0 | 23.5 | 21.4 | 21.4 | 21.1 | 0.0 | 22.5 |
| | | 100 | 0 | 22.8 | 22.9 | 22.7 | 1.0 | 23.5 | 21.4 | 21.5 | 21.2 | 0.0 | 22.5 |
| | 16QAM | 1 | 0 | 22.8 | 22.8 | 22.9 | 1.0 | 23.5 | 21.4 | 21.5 | 21.2 | 0.0 | 22.5 |
| | | 1 | 49 | 22.9 | 22.8 | 22.9 | 1.0 | 23.5 | 21.5 | 21.5 | 21.1 | 0.0 | 22.5 |
| | | 1 | 99 | 22.8 | 22.7 | 22.8 | 1.0 | 23.5 | 21.5 | 21.4 | 21.0 | 0.0 | 22.5 |
| | | 50 | 0 | 21.8 | 22.0 | 21.9 | 2.0 | 22.5 | 21.3 | 21.6 | 21.3 | 0.0 | 22.5 |
| | | 50 | 24 | 21.9 | 22.0 | 21.9 | 2.0 | 22.5 | 21.4 | 21.6 | 21.4 | 0.0 | 22.5 |
| | | 50 | 50 | 21.9 | 22.0 | 21.8 | 2.0 | 22.5 | 21.3 | 21.6 | 21.2 | 0.0 | 22.5 |
| | | 100 | 0 | 21.9 | 22.0 | 21.8 | 2.0 | 22.5 | 21.4 | 21.6 | 21.3 | 0.0 | 22.5 |
| | 64QAM | 1 | 0 | 21.7 | 22.3 | 21.9 | 2.0 | 22.5 | 21.0 | 21.5 | 21.3 | 0.0 | 22.5 |
| | | 1 | 49 | 21.9 | 22.4 | 21.9 | 2.0 | 22.5 | 21.1 | 21.6 | 21.3 | 0.0 | 22.5 |
| | | 1 | 99 | 21.8 | 22.3 | 21.7 | 2.0 | 22.5 | 21.1 | 21.5 | 21.1 | 0.0 | 22.5 |
| | | 50 | 0 | 20.9 | 21.0 | 20.9 | 3.0 | 21.5 | 21.4 | 21.5 | 20.8 | 0.0 | 22.5 |
| | | 50 | 24 | 21.0 | 21.0 | 20.9 | 3.0 | 21.5 | 21.5 | 21.6 | 20.8 | 0.0 | 22.5 |
| | | 50 | 50 | 20.9 | 21.0 | 20.8 | 3.0 | 21.5 | 21.5 | 21.5 | 20.6 | 0.0 | 22.5 |
| | | 100 | 0 | 20.9 | 20.9 | 20.9 | 3.0 | 21.5 | 21.4 | 21.6 | 20.8 | 0.0 | 22.5 |

| BW (MHz) | Mode | RB Allocation | RB offset | Maximum Average Power (dBm) | | | | | Grip Sensor Reduced Average Power (dBm) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 40315 | 40740 | 41165 | MPR | Tune-up Limit | 40315 | 40740 | 41165 | MPR | Tune-up Limit |
| | | | | 2562.5 MHz | 2605 MHz | 2647.5 MHz | | | 2562.5 MHz | 2605 MHz | 2647.5 MHz | | |
| 15 MHz | QPSK | 1 | 0 | 23.7 | 23.9 | 23.8 | 0.0 | 24.5 | 21.3 | 21.3 | 21.2 | 0.0 | 22.5 |
| | | 1 | 37 | 23.7 | 23.9 | 23.8 | 0.0 | 24.5 | 21.4 | 21.3 | 21.1 | 0.0 | 22.5 |
| | | 1 | 74 | 23.8 | 23.8 | 23.7 | 0.0 | 24.5 | 21.3 | 21.2 | 21.0 | 0.0 | 22.5 |
| | | 36 | 0 | 22.8 | 22.9 | 22.7 | 1.0 | 23.5 | 21.3 | 21.4 | 21.1 | 0.0 | 22.5 |
| | | 36 | 20 | 22.8 | 22.9 | 22.8 | 1.0 | 23.5 | 21.3 | 21.4 | 21.1 | 0.0 | 22.5 |
| | | 36 | 39 | 22.8 | 22.9 | 22.7 | 1.0 | 23.5 | 21.3 | 21.3 | 21.0 | 0.0 | 22.5 |
| | | 75 | 0 | 22.8 | 22.8 | 22.7 | 1.0 | 23.5 | 21.3 | 21.3 | 21.1 | 0.0 | 22.5 |
| | 16QAM | 1 | 0 | 22.8 | 22.9 | 22.9 | 1.0 | 23.5 | 21.3 | 21.4 | 21.2 | 0.0 | 22.5 |
| | | 1 | 37 | 22.8 | 23.0 | 22.9 | 1.0 | 23.5 | 21.4 | 21.4 | 21.1 | 0.0 | 22.5 |
| | | 1 | 74 | 22.8 | 22.9 | 22.8 | 1.0 | 23.5 | 21.4 | 21.3 | 21.0 | 0.0 | 22.5 |
| | | 36 | 0 | 21.8 | 21.9 | 21.8 | 2.0 | 22.5 | 21.4 | 21.4 | 21.2 | 0.0 | 22.5 |
| | | 36 | 20 | 21.9 | 22.0 | 21.9 | 2.0 | 22.5 | 21.4 | 21.5 | 21.1 | 0.0 | 22.5 |
| | | 36 | 39 | 21.9 | 21.9 | 21.8 | 2.0 | 22.5 | 21.4 | 21.4 | 21.1 | 0.0 | 22.5 |
| | | 75 | 0 | 21.9 | 21.9 | 21.8 | 2.0 | 22.5 | 21.4 | 21.4 | 21.2 | 0.0 | 22.5 |
| | 64QAM | 1 | 0 | 22.1 | 21.5 | 21.7 | 2.0 | 22.5 | 21.9 | 22.2 | 21.9 | 0.0 | 22.5 |
| | | 1 | 37 | 22.2 | 21.5 | 21.7 | 2.0 | 22.5 | 21.9 | 22.2 | 21.8 | 0.0 | 22.5 |
| | | 1 | 74 | 22.2 | 21.4 | 21.6 | 2.0 | 22.5 | 21.9 | 22.1 | 21.7 | 0.0 | 22.5 |
| | | 36 | 0 | 21.0 | 21.0 | 20.8 | 3.0 | 21.5 | 21.4 | 21.3 | 20.7 | 0.0 | 22.5 |
| | | 36 | 20 | 21.0 | 21.0 | 20.8 | 3.0 | 21.5 | 21.4 | 21.3 | 20.6 | 0.0 | 22.5 |
| | | 36 | 39 | 20.9 | 21.0 | 20.8 | 3.0 | 21.5 | 21.5 | 21.3 | 20.6 | 0.0 | 22.5 |
| | | 75 | 0 | 20.9 | 20.9 | 20.8 | 3.0 | 21.5 | 21.3 | 21.3 | 20.6 | 0.0 | 22.5 |


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## LTE Band 41 Measured Results (continued)

| BW (MHz) | Mode | RB Allocation | RB offset | Maximum Average Power (dBm) | | | | | Grip Sensor Reduced Average Power (dBm) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 40290 | 40740 | 41190 | MPR | Tune-up Limit | 40290 | 40740 | 41190 | MPR | Tune-up Limit |
| | | | | 2560 MHz | 2605 MHz | 2650 MHz | | | 2560 MHz | 2605 MHz | 2650 MHz | | |
| 10 MHz | QPSK | 1 | 0 | 23.8 | 23.7 | 23.7 | 0.0 | 24.5 | 21.2 | 21.4 | 21.1 | 0.0 | 22.5 |
| | | 1 | 25 | 23.8 | 23.7 | 23.7 | 0.0 | 24.5 | 21.2 | 21.4 | 21.0 | 0.0 | 22.5 |
| | | 1 | 49 | 23.8 | 23.7 | 23.7 | 0.0 | 24.5 | 21.2 | 21.3 | 21.0 | 0.0 | 22.5 |
| | | 25 | 0 | 22.3 | 22.4 | 22.2 | 1.0 | 23.5 | 21.3 | 21.4 | 21.1 | 0.0 | 22.5 |
| | | 25 | 12 | 22.3 | 22.4 | 22.2 | 1.0 | 23.5 | 21.3 | 21.4 | 21.1 | 0.0 | 22.5 |
| | | 25 | 25 | 22.3 | 22.4 | 22.2 | 1.0 | 23.5 | 21.3 | 21.4 | 21.1 | 0.0 | 22.5 |
| | | 50 | 0 | 22.3 | 22.3 | 22.2 | 1.0 | 23.5 | 21.3 | 21.4 | 21.1 | 0.0 | 22.5 |
| | 16QAM | 1 | 0 | 22.9 | 22.8 | 22.8 | 1.0 | 23.5 | 21.2 | 21.4 | 21.2 | 0.0 | 22.5 |
| | | 1 | 25 | 23.0 | 22.8 | 22.7 | 1.0 | 23.5 | 21.3 | 21.4 | 21.2 | 0.0 | 22.5 |
| | | 1 | 49 | 23.0 | 22.8 | 22.7 | 1.0 | 23.5 | 21.3 | 21.4 | 21.2 | 0.0 | 22.5 |
| | | 25 | 0 | 21.9 | 21.9 | 21.8 | 2.0 | 22.5 | 21.3 | 21.5 | 21.2 | 0.0 | 22.5 |
| | | 25 | 12 | 21.9 | 22.0 | 21.8 | 2.0 | 22.5 | 21.4 | 21.5 | 21.2 | 0.0 | 22.5 |
| | | 25 | 25 | 21.9 | 21.9 | 21.8 | 2.0 | 22.5 | 21.4 | 21.5 | 21.2 | 0.0 | 22.5 |
| | | 50 | 0 | 21.9 | 21.9 | 21.8 | 2.0 | 22.5 | 21.4 | 21.5 | 21.2 | 0.0 | 22.5 |
| | 64QAM | 1 | 0 | 22.1 | 21.5 | 21.8 | 2.0 | 22.5 | 22.5 | 21.9 | 21.6 | 0.0 | 22.5 |
| | | 1 | 25 | 22.2 | 21.5 | 21.8 | 2.0 | 22.5 | 22.5 | 21.9 | 21.6 | 0.0 | 22.5 |
| | | 1 | 49 | 22.2 | 21.5 | 21.8 | 2.0 | 22.5 | 22.5 | 21.9 | 21.6 | 0.0 | 22.5 |
| | | 25 | 0 | 20.8 | 21.0 | 20.7 | 3.0 | 21.5 | 21.3 | 21.4 | 20.5 | 0.0 | 22.5 |
| | | 25 | 12 | 20.9 | 21.0 | 20.8 | 3.0 | 21.5 | 21.3 | 21.4 | 20.5 | 0.0 | 22.5 |
| | | 25 | 25 | 20.8 | 21.0 | 20.7 | 3.0 | 21.5 | 21.3 | 21.5 | 20.5 | 0.0 | 22.5 |
| | | 50 | 0 | 20.8 | 20.9 | 20.8 | 3.0 | 21.5 | 21.3 | 21.4 | 20.5 | 0.0 | 22.5 |

| BW (MHz) | Mode | RB Allocation | RB offset | Maximum Average Power (dBm) | | | | | Grip Sensor Reduced Average Power (dBm) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 40265 | 40740 | 41215 | MPR | Tune-up Limit | 40265 | 40740 | 41215 | MPR | Tune-up Limit |
| | | | | 2557.5 MHz | 2605 MHz | 2652.5 MHz | | | 2557.5 MHz | 2605 MHz | 2652.5 MHz | | |
| 5 MHz | QPSK | 1 | 0 | 23.7 | 23.8 | 23.7 | 0.0 | 24.5 | 21.2 | 21.2 | 20.9 | 0.0 | 22.5 |
| | | 1 | 12 | 23.7 | 23.8 | 23.7 | 0.0 | 24.5 | 21.1 | 21.2 | 20.9 | 0.0 | 22.5 |
| | | 1 | 24 | 23.7 | 23.8 | 23.7 | 0.0 | 24.5 | 21.1 | 21.2 | 20.9 | 0.0 | 22.5 |
| | | 12 | 0 | 22.8 | 22.9 | 22.8 | 1.0 | 23.5 | 21.2 | 21.2 | 20.9 | 0.0 | 22.5 |
| | | 12 | 7 | 22.8 | 22.9 | 22.8 | 1.0 | 23.5 | 21.2 | 21.3 | 21.0 | 0.0 | 22.5 |
| | | 12 | 13 | 22.8 | 22.9 | 22.7 | 1.0 | 23.5 | 21.2 | 21.3 | 20.9 | 0.0 | 22.5 |
| | | 25 | 0 | 22.8 | 22.9 | 22.7 | 1.0 | 23.5 | 21.2 | 21.3 | 20.9 | 0.0 | 22.5 |
| | 16QAM | 1 | 0 | 22.7 | 22.8 | 22.9 | 1.0 | 23.5 | 21.2 | 21.2 | 21.1 | 0.0 | 22.5 |
| | | 1 | 12 | 22.7 | 22.9 | 22.9 | 1.0 | 23.5 | 21.2 | 21.2 | 21.1 | 0.0 | 22.5 |
| | | 1 | 24 | 22.7 | 22.9 | 22.8 | 1.0 | 23.5 | 21.1 | 21.2 | 21.1 | 0.0 | 22.5 |
| | | 12 | 0 | 21.8 | 21.9 | 21.8 | 2.0 | 22.5 | 21.2 | 21.3 | 21.1 | 0.0 | 22.5 |
| | | 12 | 7 | 21.8 | 21.9 | 21.9 | 2.0 | 22.5 | 21.3 | 21.3 | 21.1 | 0.0 | 22.5 |
| | | 12 | 13 | 21.9 | 21.9 | 21.8 | 2.0 | 22.5 | 21.3 | 21.3 | 21.1 | 0.0 | 22.5 |
| | | 25 | 0 | 21.8 | 22.0 | 21.8 | 2.0 | 22.5 | 21.2 | 21.3 | 21.0 | 0.0 | 22.5 |
| | 64QAM | 1 | 0 | 22.0 | 22.3 | 21.5 | 2.0 | 22.5 | 22.4 | 22.5 | 21.2 | 0.0 | 22.5 |
| | | 1 | 12 | 22.0 | 22.3 | 21.5 | 2.0 | 22.5 | 22.4 | 22.5 | 21.2 | 0.0 | 22.5 |
| | | 1 | 24 | 22.0 | 22.3 | 21.5 | 2.0 | 22.5 | 22.4 | 22.5 | 21.2 | 0.0 | 22.5 |
| | | 12 | 0 | 20.7 | 21.1 | 20.8 | 3.0 | 21.5 | 21.2 | 21.5 | 20.5 | 0.0 | 22.5 |
| | | 12 | 7 | 20.8 | 21.1 | 20.8 | 3.0 | 21.5 | 21.2 | 21.5 | 20.5 | 0.0 | 22.5 |
| | | 12 | 13 | 20.8 | 21.0 | 20.8 | 3.0 | 21.5 | 21.2 | 21.5 | 20.5 | 0.0 | 22.5 |
| | | 25 | 0 | 20.8 | 20.9 | 20.8 | 3.0 | 21.5 | 21.2 | 21.3 | 20.5 | 0.0 | 22.5 |


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## 9.5. LTE Carrier Aggregation

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

For inter-band carrier aggregation with uplink assigned to one E-UTRA band (Table 5.6A-1), the requirements in subclause 6.2.3 apply.

For inter-band carrier aggregation with one component carrier per operating band and the uplink active in two E-UTRA bands, the requirements in subclause 6.2.3 apply for each uplink component carrier.

For intra-band contiguous carrier aggregation the allowed Maximum Power Reduction (MPR) for the maximum output power applicable to the DUT in table below. In case the modulation format is different on different component carriers then the MPR is determined by the rules applied to higher order of those modulations.

| Modulation | CA bandwidth Class B and C / Smallest Component Carrier Transmission Bandwidth Configuration | | | | MPR (dB) |
|---|---|---|---|---|---|
| | 25 RB | 50 RB | 75 RB | 100 RB | |
| QPSK | > 8 and ≤ 25 | > 12 and ≤ 50 | > 16 and ≤ 75 | > 18 and ≤ 100 | ≤ 1 |
| QPSK | > 25 | > 50 | > 75 | > 100 | ≤ 2 |
| 16 QAM | ≤ 8 | ≤ 12 | ≤ 16 | ≤ 18 | ≤ 1 |
| 16 QAM | > 8 and ≤ 25 | > 12 and ≤ 50 | > 16 and ≤ 75 | > 18 and ≤ 100 | ≤ 2 |
| 16 QAM | > 25 | > 50 | > 75 | > 100 | ≤ 3 |
| 64 QAM | ≤ 8 and allocation wholly contained within a single CC | ≤ 12 and allocation wholly contained within a single CC | ≤ 16 and allocation wholly contained within a single CC | ≤ 18 and allocation wholly contained within a single CC | ≤ 2 |
| 64 QAM | > 8 or allocation extends across two CC's | > 12 or allocation extends across two CC's | > 16 or allocation extends across two CC's | > 18 or allocation extends across two CC's | ≤ 3 |

For PUCCH and SRS transmissions, the allowed MPR is according to that specified for PUSCH WPDK modulation for the corresponding transmission bandwidth.

For intra-band contiguous carrier aggregation bandwidth class C with non-contiguous resource allocation, the allowed Maximum Power Reduction (MPR) for the maximum output power in Table 6.2.2A-1 is specified as follows


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$$MPR = CEIL\ \{\min(M_A, M_{IM5}), 0.5\}$$

Where $M_A$ is defined as follows

| | | |
|---|---|---|
| $M_A =$ | 8.2 | ;$0 \le A < 0.025$ |
| | 9.2 – 40A | ;$0.025 \le A < 0.05$ |
| | 8 – 16A | ;$0.05 \le A < 0.25$ |
| | 4.83 – 3.33A | ;$0.25 \le A \le 0.4$ |
| | 3.83 – 0.83A | ;$0.4 \le A \le 1$ |

and $M_{IM5}$ is defined as follows

| | | |
|---|---|---|
| $M_{IM5} =$ | 4.5 | ; $\Delta_{IM5} < 1.5 * BW_{Channel_CA}$ |
| | 6.0 | ; $1.5 * BW_{Channel_CA} \le \Delta_{IM5} < BW_{Channel_CA}/2 + \Delta f_{ooB}$ |
| | $M_A$ | ; $\Delta_{IM5} \ge BW_{Channel_CA}/2 + \Delta f_{ooB}$ |

Where

$A = N_{RB_alloc} / N_{RB_agg}$

$\Delta_{IM5} = \max(\left| F_{C_agg} - (3*F_{agg_alloc_low} - 2*F_{agg_alloc_high}) \right|, \left| F_{C_agg} - (3*F_{agg_alloc_high} - 2*F_{agg_alloc_low}) \right|)$

CEIL{$M_A$, 0.5} means rounding upwards to closest 0.5dB, i.e. MPR $\in$ [3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0, 6.5, 7.0, 7.5, 8.0, 8.5]

For intra-band carrier aggregation, the MPR is evaluated per slot and given by the maximum value taken over the transmission(s) on all component carriers within the slot; the maximum MPR over the two slots is then applied for the entire subframe.

For intra-band non-contiguous carrier aggregation with one uplink carrier on the PCC, the requirements in the subclause 6.2.3 apply. For intra-band non-contiguous aggregation with two uplink carriers the MPR is defined tfor those E-UTRA bands where maximum possible $W_{GAP} \le 42.2$ MHz as follows

$$MPR = CEIL\{M_A, 0.5\}$$

Where $M_N$ is defined as follows

| | | |
|---|---|---|
| $M_N =$ | -0.125N + 18.25 | ; $2 \le N \le 50$ |
| | -0.0333 N + 13.67 | ; $50 < N \le 200$ |

Where $N = N_{RB_alloc}$ is the number of allocated resource blocks.

For the UE maximum output power modified by MPR, the power limits specified in subclause 6.2.5A apply.


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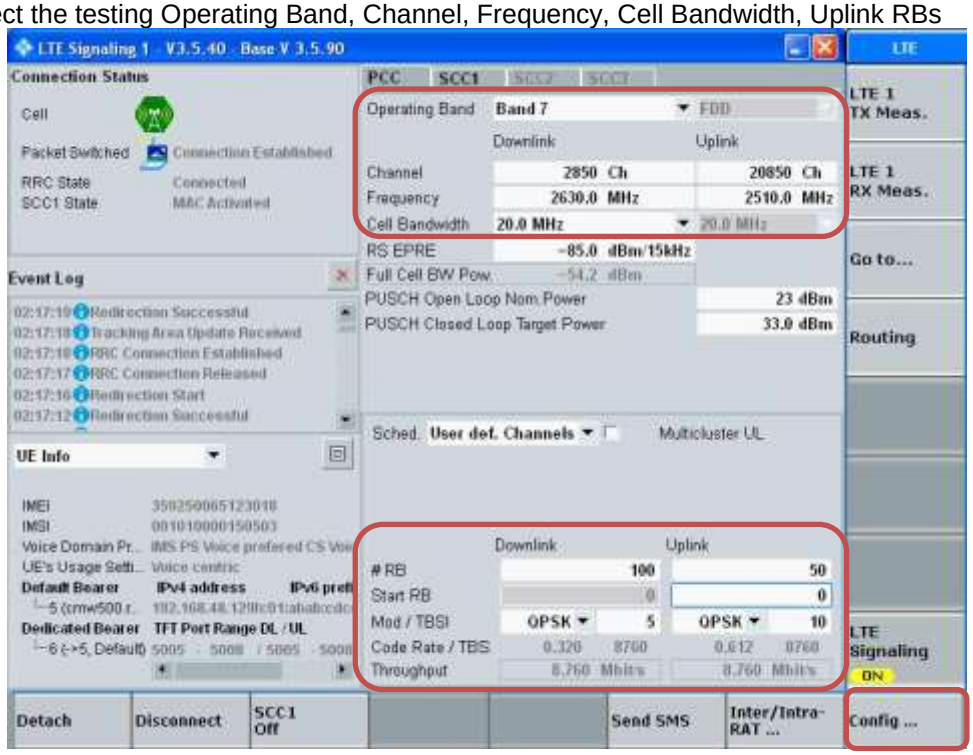
**LTE Carrier Aggregation Test Signal Set-up Procedure**
**(Use normal LTE set-up procedure in addition with the following steps)**

Set to CMW-500 with following parameters:

- PCC tab:
  - Select the testing Operating Band, Channel, Frequency, Cell Bandwidth, Uplink RBs
- 

- Go to “Config….”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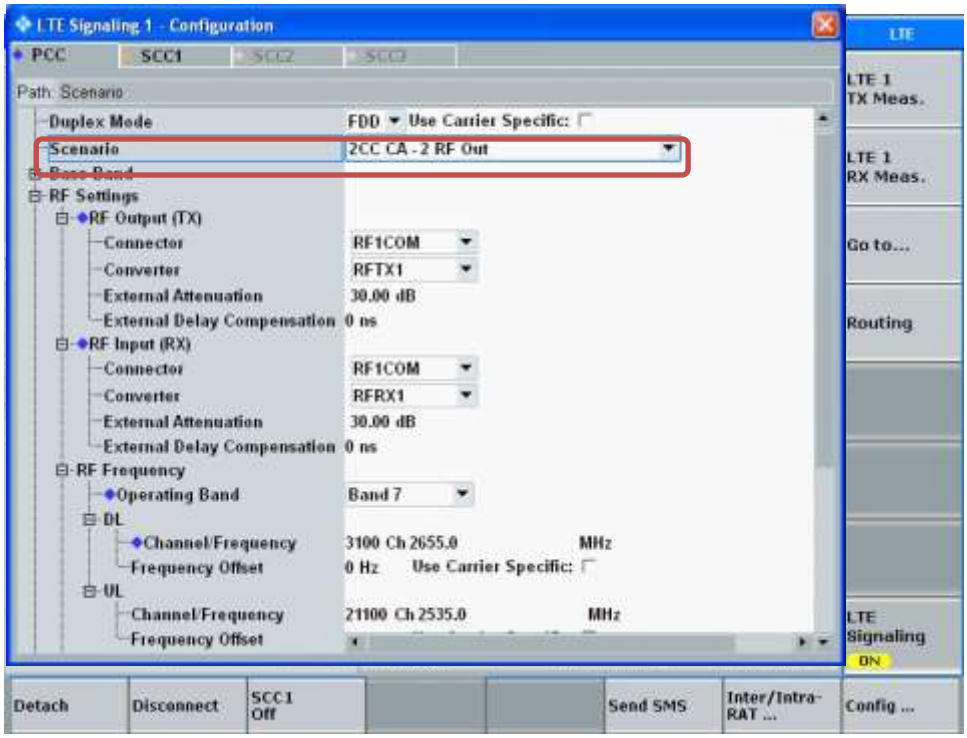
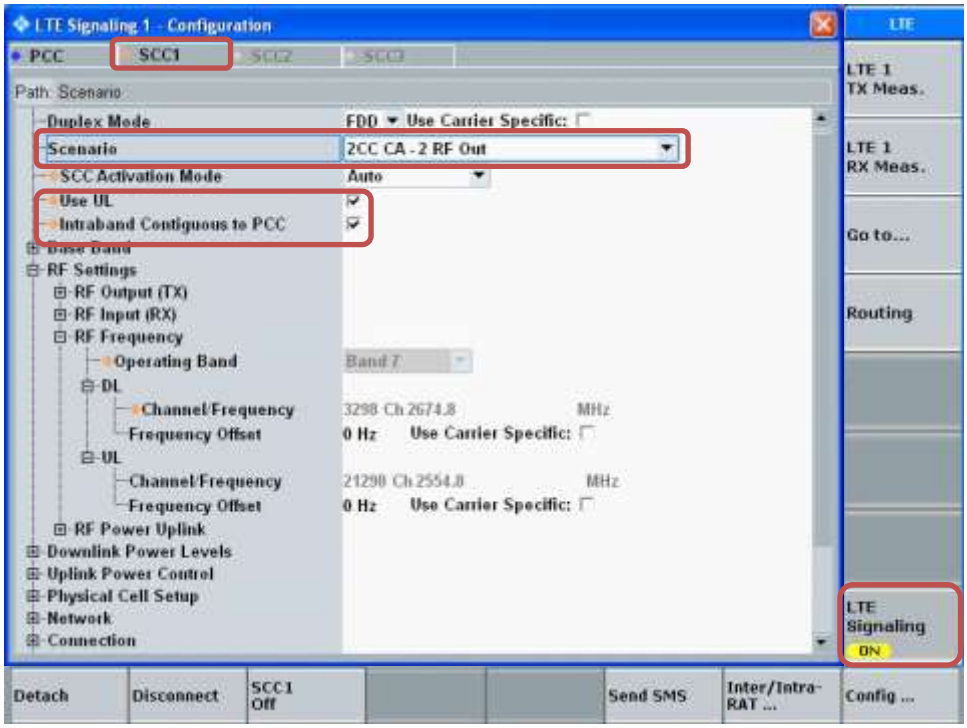
- Go to “Scenario”
- Set to “2CC CA – 2 RF Out”




- Select “SCC1” tab
- Go to “Scenario”
- Set to “2CC CA – 2 RF Out”
- Enable “Use UL”
- Enable “Intraband Contiguous to PCC”
- Select “LTE Signaling” button





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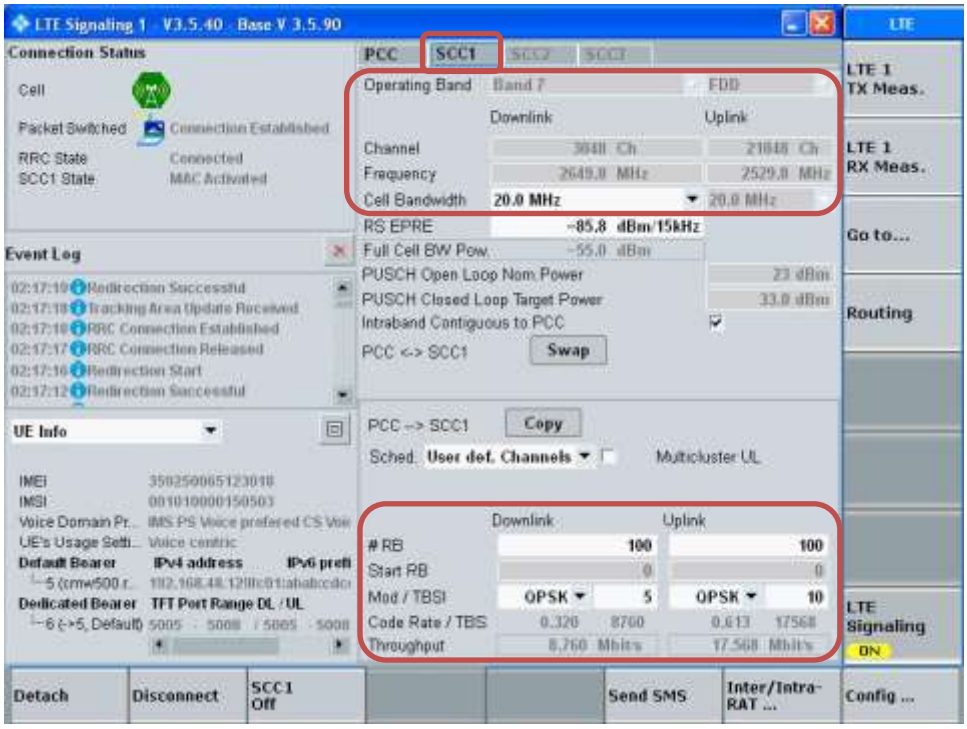
- Select “SCC1” tab
  - Select the testing Cell Bandwidth, Uplink RBs





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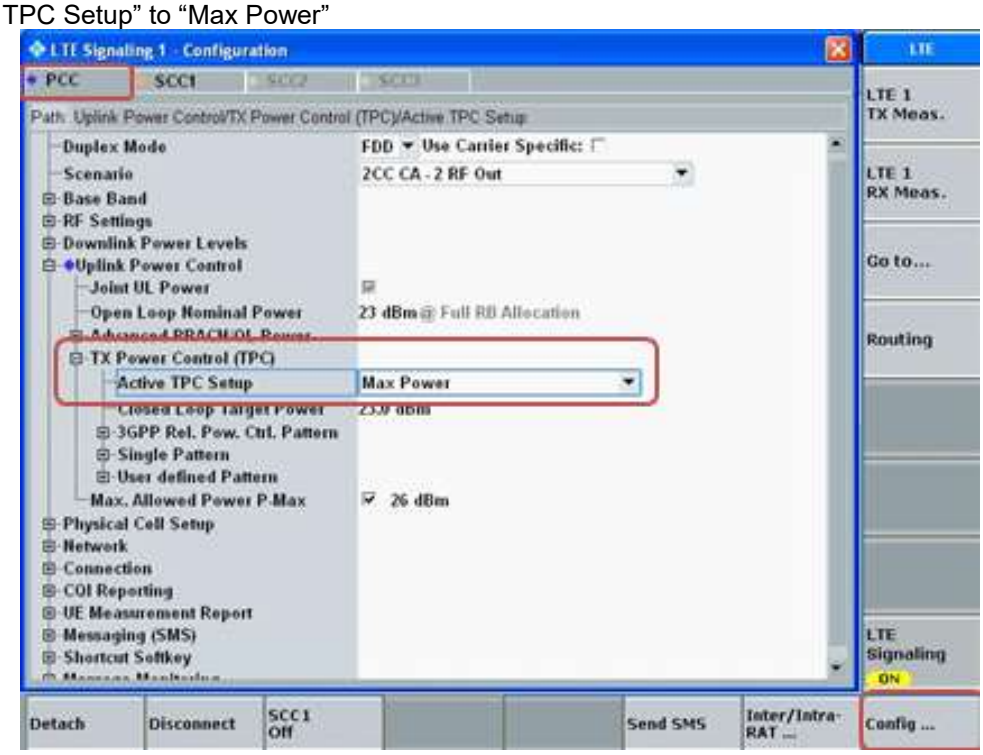
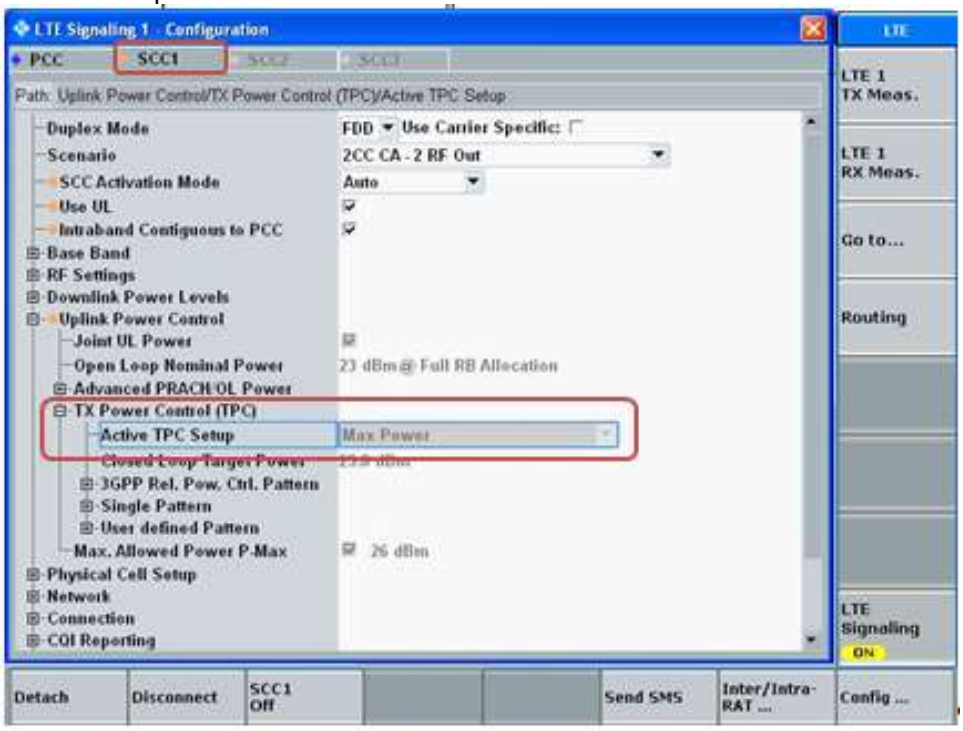
**Max Power Setting**

- Select “Config …” button
- Select PCC tab
- Set “Active TPC Setup” to “Max Power”




- Select SCC1 tab
- Verify that “Active TPC Setup” is set to “Max Power”





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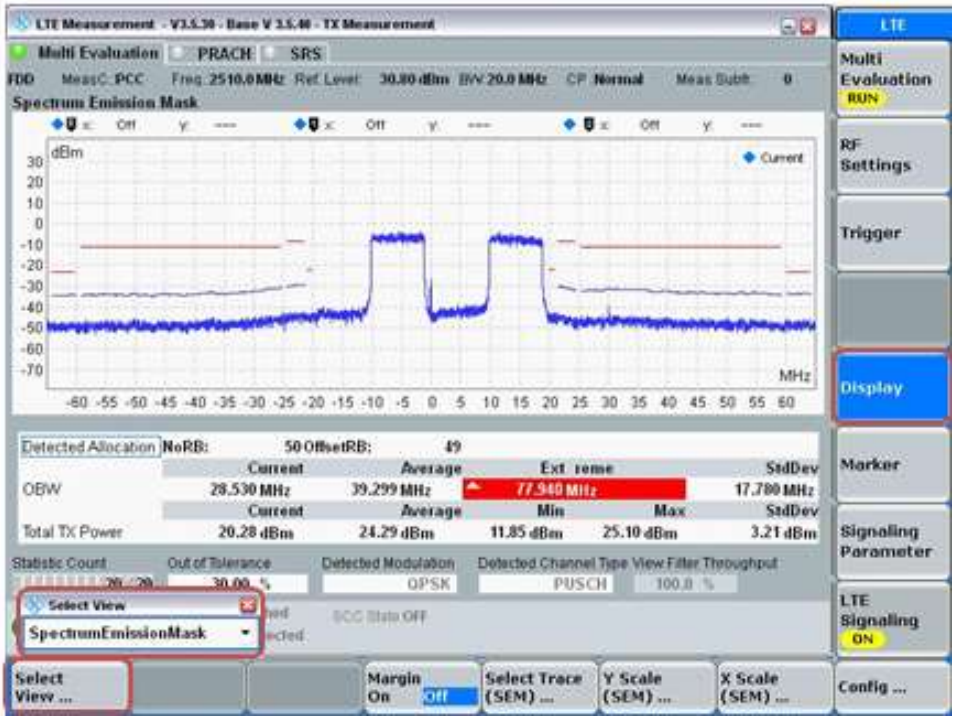
**View TX Power**

- Go to “Display”
- Select “Select View…”
- Select “Spectrum Emission Mask”





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## LTE Up-Link Carrier Aggregation

### Maximum Output Power (Tune-up Limit) for LTE UL Carrier Aggregation

UL CA shall be tested based on the worst-case SAR configuration determined from non-CA SAR testing result. The channel BW, channel number, RB allocation, etc. would be selected to allow contiguous CA of PCC and SCC. Uplink output power for UL CA is the total power measured across the PCC and SCC.

The UL CA mode power measurements represent the total power across both carriers. Measurements were made for all supported PCC bandwidths using the channel/RB combination resulting in the highest standalone output power at the least MPR (0 dB). SCCs were set to use configurations similar to the PCC to establish conservative or worst case equivalent SAR test conditions (highest maximum power with MPR of 0 dB).

The standalone power measurement is the power for the PCC in the non-CA mode (i.e. single carrier power). In all cases the UL CA power is less than or equal to the standalone power, which is in accordance with the tune-up limits in table below.

According to November 2017 TCB workshop, Uplink CA SAR Test Guidance as follows:

a) When the maximum output for UL CA is ≤ standalone LTE mode (without CA)
   - PCC is configured according to the highest standalone SAR configuration tested
   - SCC and subsequent CCs are configured according to procedures used for power measurement and parameters (BW, RB etc.) similar to that used for the PCC
b) When the Reported SAR for UL CA configuration, described above, is > 1.2 W/kg, UL CA SAR is also required for all required test channels(PCC based)
c) UL CA SAR is also required for standalone SAR configurations > 1.2 W/kg when they are scaled to the UL CA power level

SAR measurement is not required for the 16QAM and 64QAM. When primary mode and the adjusted SAR is ≤ 1.2 W/kg and secondary mode is ≤ ¼ dB higher than the primary mode.

### UL Intra-Band Contiguous Measured Results

| RF Exposure Conditions | E-UTRA CA configuration (BCS) | Modulation | Bands | | UL | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | PCC | SCC | PCC | | | | SCC | | | | Standalone (dBm) | PCC+SCC | | |
| | | | 1st | 2nd | BW | RB | Offset | Freq | BW | RB | Offset | Freq | | Tune-Up Limit | CA Power (Total PCC+SCC) | Delta (dBm) |
| Head, Body & Hotspot | CA_41C | QPSK | 41C | 41C | 20 | 1 | 99 | 2583.1 | 20 | 1 | 0 | 2602.9 | 24.4 | 24.5 | 24.4 | 0.0 |
| Grip Sensor (Product Specific) | CA_41C | QPSK | 41C | 41C | 20 | 1 | 99 | 2583.1 | 20 | 1 | 0 | 2602.9 | 21.5 | 22.5 | 21.4 | -0.1 |


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**LTE Down-Link Carrier Aggregation**

The tables below show the supported frequency bands of the device for DL Intra-band combinations.

Power measurements were performed on the channel with the highest maximum output power from Tune-up Procedure.

When carrier aggregation is limited to downlink only, uplink maximum output power (single carrier) is measured for the supported combinations of downlink carrier aggregation listed in the table below. In applying the power measurement procedures of KDB 941225 D05A for DL CA to qualify for UL SAR test exclusion, power measurement is required only for the subset in each row with the largest combination of frequency bands and CCs (far right most configuration highlighted in the table below).

| Index | 2CC | Restriction | Completely Covered by Measurement Superset |
|---|---|---|---|
| **Intra-Band Contiguous** | | | |
| 2CC# 1 | CA_41C | N/A | No |

In applying the power measurement procedures of KDB 941225 D05A for DL CA to qualify for UL SAR test exclusion, power measurement is required only for the CA configuration with the largest aggregated DL CA BW in each frequency band, independently for contiguous and non-contiguous CA; however, if the same frequency band is used for both contiguous and non-contiguous CA, power measurement was performed using the configuration with the largest aggregated BW and maximum output power among contiguous and non-contiguous CA.

**DL Intra-Band Contiguous Measured Results**

| E-UTRA CA configuration (BCS) | 3GPP Rel. # | CC1 (UL) | | | | | CC2 (DL) | | | Aggregated BW | MPR | CA Inactive (dBm) | CA Active (dBm) | Delta (dBm) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Mode | BW (MHz) | Channel | Freq (MHz) | RB,Offset | BW (MHz) | Channel | Freq (MHz) | | | | | |
| CA_41C | 13 | QPSK | 20 | 40521 | 2583.1 | 1,49 | 20 | 40719 | 2602.9 | 40 | 0 | 23.93 | 23.89 | -0.04 |


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## 9.6. Wi-Fi 2.4GHz (DTS Band)

**Wi-Fi 2.4GHz Measured Results**

The maximum output power specified for production units are determined for all applicable 802.11 transmission modes in each standalone and aggregated frequency band. Maximum output power is measured for the highest maximum output power configuration(s) in each frequency band according to the default power measurement procedures.
For “Not required”, SAR Test reduction was applied from KDB 248227 guidance, Sec. 2.1, b), 1) when the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11b/g/n mode is used for SAR measurement, on the highest measured output power channel in the initial test configuration, for each frequency band. Additional output power measurements were not deemed necessary.
SAR testing is not required for OFDM mode(s) when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.

| Band | Mode | Data Rate | Ch # | Freq. (MHz) | Maximum Average Power (dBm) | | | Reduced Average Power (dBm) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Meas Pwr | Tune-up | SAR Test (Yes/No) | Meas Pwr | Tune-up | SAR Test (Yes/No) |
| DSSS 2.4 GHz | 802.11b | 1 Mbps | 1 | 2412 | 18.9 | 19.0 | Yes | 14.0 | 14.0 | Yes |
| | | | 6 | 2437 | 19.0 | 19.0 | | 14.0 | 14.0 | |
| | | | 11 | 2462 | 18.7 | 19.0 | | 14.0 | 14.0 | |
| OFDM 2.4 GHz | 802.11g | 6 Mbps | 1 | 2412 | Not Required | 16.0 | No | 14.0 | 14.0 | No |
| | | | 6 | 2437 | | 18.0 | | 14.0 | 14.0 | |
| | | | 11 | 2462 | | 18.0 | | 14.0 | 14.0 | |
| | 802.11n (HT20) | 6.5 Mbps | 1 | 2412 | Not Required | 16.0 | No | 13.9 | 14.0 | No |
| | | | 6 | 2437 | | 18.0 | | 14.0 | 14.0 | |
| | | | 11 | 2462 | | 18.0 | | 14.0 | 14.0 | |

**Note(s):**
SAR is not required for channels 12 and 13 because the tune-up limit and the measured output power for these two channels are not greater than those for the default test channels.

**Duty Factor Measured Results**

| Mode | Type | T on (ms) | Period (ms) | Duty Cycle | Crest Factor (1/duty cycle) |
|---|---|---|---|---|---|
| 802.11b | 1 Mbps | 8.621 | 8.755 | 98.47% | 1.02 |

**Note(s):**
Duty Cycle = (T on / period) * 100%


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# Duty Cycle plots

802.11b

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## 9.7. Wi-Fi 5GHz (U-NII Bands)

When the same transmission mode configurations have the same maximum output power on the same channel for the 802.11 a/g/n/ac modes, the channel in the lower order/sequence 802.11 mode (i.e. a, g, n then ac) is selected. The maximum output power specified for production units are determined for all applicable 802.11 transmission modes in each standalone and aggregated frequency band. Maximum output power is measured for the highest maximum output power configuration(s) in each frequency band according to the default power measurement procedures.

**Wi-Fi 5 GHz Measured Results**

When the specified maximum output power is the same for both UNII 1 and UNII 2A, begin SAR measurements in UNII 2A with the channel with the highest measured output power. If the reported SAR for UNII 2A is ≤ 1.2 W/kg, SAR is not required for UNII 1; otherwise treat the remaining bands separately and test them independently for SAR.

| Band | Mode | Data Rate | Ch # | Freq. (MHz) | Maximum Average Power (dBm) | | | Reduced Average Power (dBm) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Meas Pwr | Tune-up | SAR Test (Yes/No) | Meas Pwr | Tune-up | SAR Test (Yes/No) |
| UNII-1 5.2 GHz | 802.11a | 6 Mbps | 36 | 5180 | | 18.0 | No | | 11.0 | No |
| | | | 40 | 5200 | | 18.0 | | | 11.0 | |
| | | | 44 | 5220 | | 18.0 | | | 11.0 | |
| | | | 48 | 5240 | | 18.0 | | | 11.0 | |
| | 802.11n (HT20) | 6.5 Mbps | 36 | 5180 | 19.0 | 19.0 | Yes | | 11.0 | No |
| | | | 40 | 5200 | 19.0 | 19.0 | | | 11.0 | |
| | | | 44 | 5220 | 19.0 | 19.0 | | | 11.0 | |
| | | | 48 | 5240 | 19.0 | 19.0 | | | 11.0 | |
| | 802.11ac (VHT20) | 6.5 Mbps | 36 | 5180 | 18.9 | 19.0 | No | | 11.0 | No |
| | | | 40 | 5200 | 19.0 | 19.0 | | | 11.0 | |
| | | | 44 | 5220 | 19.0 | 19.0 | | | 11.0 | |
| | | | 48 | 5240 | 19.0 | 19.0 | | | 11.0 | |
| | 802.11n (HT40) | 13.5 Mbps | 38 | 5190 | | 17.0 | No | | 11.0 | No |
| | | | 46 | 5230 | | 18.0 | | | 11.0 | |
| | 802.11ac (VHT40) | 13.5 Mbps | 38 | 5190 | | 18.0 | No | | 11.0 | No |
| | | | 46 | 5230 | | 18.0 | | | 11.0 | |
| | 802.11ac (VHT80) | 29.3 Mbps | 42 | 5210 | | 16.0 | No | 11.0 | 11.0 | Yes |
| Band | Mode | Data Rate | Ch # | Freq. (MHz) | Maximum Average Power (dBm) | | | Reduced Average Power (dBm) | | |
| | | | | | Meas Pwr | Tune-up | SAR Test (Yes/No) | Meas Pwr | Tune-up | SAR Test (Yes/No) |
| UNII-2A 5.3 GHz | 802.11a | 6 Mbps | 52 | 5260 | | 18.0 | No | | 11.0 | No |
| | | | 56 | 5280 | | 18.0 | | | 11.0 | |
| | | | 60 | 5300 | | 18.0 | | | 11.0 | |
| | | | 64 | 5320 | | 18.0 | | | 11.0 | |
| | 802.11n (HT20) | 6.5 Mbps | 52 | 5260 | 18.9 | 19.0 | Yes | | 11.0 | No |
| | | | 56 | 5280 | 19.0 | 19.0 | | | 11.0 | |
| | | | 60 | 5300 | 19.0 | 19.0 | | | 11.0 | |
| | | | 64 | 5320 | 19.0 | 19.0 | | | 11.0 | |
| | 802.11ac (VHT20) | 6.5 Mbps | 52 | 5260 | 19.0 | 19.0 | No | | 11.0 | No |
| | | | 56 | 5280 | 19.0 | 19.0 | | | 11.0 | |
| | | | 60 | 5300 | 19.0 | 19.0 | | | 11.0 | |
| | | | 64 | 5320 | 19.0 | 19.0 | | | 11.0 | |
| | 802.11n (HT40) | 13.5 Mbps | 54 | 5270 | | 18.0 | No | | 11.0 | No |
| | | | 62 | 5310 | | 18.0 | | | 11.0 | |
| | 802.11ac (VHT40) | 13.5 Mbps | 54 | 5270 | | 18.0 | No | | 11.0 | No |
| | | | 62 | 5310 | | 18.0 | | | 11.0 | |
| | 802.11ac (VHT80) | 29.3 Mbps | 58 | 5290 | | 16.0 | No | 11.0 | 11.0 | Yes |


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| Band | Mode | Data Rate | Ch # | Freq. (MHz) | Maximum Average Power (dBm) | | | Reduced Average Power (dBm) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Meas Pwr | Tune-up | SAR Test (Yes/No) | Meas Pwr | Tune-up | SAR Test (Yes/No) |
| UNII-2C 5.5 GHz | 802.11a | 6 Mbps | 100 | 5500 | | 16.0 | No | | 11.0 | No |
| | | | 116 | 5580 | | 18.0 | | | 11.0 | |
| | | | 124 | 5620 | | 18.0 | | | 11.0 | |
| | | | 140 | 5700 | | 18.0 | | | 11.0 | |
| | | | 144 | 5720 | | 18.0 | | | 11.0 | |
| | 802.11n (HT20) | 6.5 Mbps | 100 | 5500 | 19.0 | 19.0 | Yes | | 11.0 | No |
| | | | 116 | 5580 | 19.0 | 19.0 | | | 11.0 | |
| | | | 124 | 5620 | 18.9 | 19.0 | | | 11.0 | |
| | | | 140 | 5700 | 18.8 | 19.0 | | | 11.0 | |
| | | | 144 | 5720 | 18.9 | 19.0 | | | 11.0 | |
| | 802.11ac (VHT20) | 6.5 Mbps | 100 | 5500 | 19.0 | 19.0 | No | | 11.0 | No |
| | | | 116 | 5580 | 19.0 | 19.0 | | | 11.0 | |
| | | | 124 | 5620 | 18.9 | 19.0 | | | 11.0 | |
| | | | 140 | 5700 | 18.8 | 19.0 | | | 11.0 | |
| | | | 144 | 5700 | 18.9 | 19.0 | | | 11.0 | |
| | 802.11n (HT40) | 13.5 Mbps | 102 | 5510 | | 17.0 | No | | 11.0 | No |
| | | | 118 | 5590 | | 18.0 | | | 11.0 | |
| | | | 126 | 5630 | | 18.0 | | | 11.0 | |
| | | | 134 | 5670 | | 18.0 | | | 11.0 | |
| | | | 142 | 5710 | | 18.0 | | | 11.0 | |
| | 802.11ac (VHT40) | 13.5 Mbps | 102 | 5510 | | 18.0 | No | | 11.0 | No |
| | | | 118 | 5590 | | 18.0 | | | 11.0 | |
| | | | 126 | 5630 | | 18.0 | | | 11.0 | |
| | | | 134 | 5670 | | 18.0 | | | 11.0 | |
| | | | 142 | 5710 | | 18.0 | | | 11.0 | |
| | 802.11ac (VHT80) | 29.3 Mbps | 106 | 5530 | | 16.0 | No | 11.0 | 11.0 | Yes |
| | | | 122 | 5610 | | 16.0 | | 11.0 | 11.0 | |
| | | | 138 | 5690 | | 16.0 | | 11.0 | 11.0 | |
| Band | Mode | Data Rate | Ch # | Freq. (MHz) | Maximum Average Power (dBm) | | | Reduced Average Power (dBm) | | |
| | | | | | Meas Pwr | Tune-up | SAR Test (Yes/No) | Meas Pwr | Tune-up | SAR Test (Yes/No) |
| UNII-3 5.8 GHz | 802.11a | 6 Mbps | 149 | 5745 | | 18.0 | No | | 11.0 | No |
| | | | 157 | 5785 | | 18.0 | | | 11.0 | |
| | | | 165 | 5825 | | 18.0 | | | 11.0 | |
| | 802.11n (HT20) | 6.5 Mbps | 149 | 5745 | 19.0 | 19.0 | Yes | | 11.0 | No |
| | | | 157 | 5785 | 19.0 | 19.0 | | | 11.0 | |
| | | | 165 | 5825 | 19.0 | 19.0 | | | 11.0 | |
| | 802.11ac (VHT20) | 6.5 Mbps | 149 | 5745 | 19.0 | 19.0 | No | | 11.0 | No |
| | | | 157 | 5785 | 19.0 | 19.0 | | | 11.0 | |
| | | | 165 | 5825 | 19.0 | 19.0 | | | 11.0 | |
| | 802.11n (HT40) | 13.5 Mbps | 151 | 5755 | | 18.0 | No | | 11.0 | No |
| | | | 159 | 5795 | | 18.0 | | | 11.0 | |
| | 802.11ac (VHT40) | 13.5 Mbps | 151 | 5755 | | 18.0 | No | | 11.0 | No |
| | | | 159 | 5795 | | 18.0 | | | 11.0 | |
| | 802.11ac (VHT80) | 29.3 Mbps | 155 | 5775 | | 16.0 | No | 11.0 | 11.0 | Yes |

## Duty Factor Measured Results

| Mode | Type | T on (ms) | Period (ms) | Duty Cycle | Crest Factor (1/duty cycle) |
|---|---|---|---|---|---|
| 802.11n | HT20 | 1.341 | 1.377 | 97.39% | 1.03 |
| 802.11ac | VHT80 | 0.3318 | 0.3681 | 90.14% | 1.11 |

**Note(s):**

Duty Cycle = (T on / period) * 100%



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## Duty Cycle plots

802.11n HT20

802.11ac VHT80

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## 9.8. Bluetooth

**Bluetooth Measured Results**

SAR measurement is not required for the QPSK, 8PSK, and BLE. When the secondary mode is ≤ ¼ dB higher than the primary mode.

| Band | Mode | Ch # | Freq. (MHz) | Maximum Average Power (dBm) | | |
|---|---|---|---|---|---|---|
| | | | | Meas Pwr | Tune-up | SAR Test (Yes/No) |
| Bluetooth | BR GFSK | 0 | 2402 | 12.0 | 12.0 | Yes |
| | | 39 | 2441 | 12.0 | 12.0 | |
| | | 78 | 2480 | 11.1 | 12.0 | |
| | EDR, π/4 DQPSK | 0 | 2402 | 10.0 | 12.0 | No |
| | | 39 | 2441 | 9.3 | 12.0 | |
| | | 78 | 2480 | 9.1 | 12.0 | |
| | EDR, 8-DPSK | 0 | 2402 | 10.0 | 12.0 | No |
| | | 39 | 2441 | 9.3 | 12.0 | |
| | | 78 | 2480 | 9.2 | 12.0 | |
| | LE, GFSK | 0 | 2402 | 0.5 | 2.0 | No |
| | | 19 | 2440 | 0.5 | 2.0 | |
| | | 39 | 2480 | 0.5 | 2.0 | |

**Duty Factor Measured Results**

| Mode | Type | T on (ms) | Period (ms) | Duty Cycle | Crest Factor (1/duty cycle) |
|---|---|---|---|---|---|
| GFSK | DH5 | 2.887 | 3.749 | 77.01% | 1.30 |

**Note(s):**

Duty Cycle = (T on / period) * 100%


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# Duty Cycle plots

GFSK

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# 10. Measured and Reported (Scaled) SAR Results

**SAR Test Reduction criteria are as follows:**

- Reported SAR(W/kg) for WWAN and Bluetooth = Measured SAR *Tune-up Scaling Factor
- Reported SAR(W/kg) for Wi-Fi= Measured SAR * Tune-up scaling factor * Duty Cycle scaling factor
- Duty Cycle scaling factor = 1 / Duty cycle (%)

**KDB 447498 D01 General RF Exposure Guidance:**

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

**KDB 648474 D04 Handset SAR:**

With headset attached, 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.

**KDB 648474 D04 Handset SAR (Phablet Only):**

For smart phones, with a display diagonal dimension > 15.0 cm or an overall diagonal dimension > 16.0 cm.
When hotspot mode does not apply, 10-g Extremity SAR is required for all surfaces and edges with an antenna located at ≤ 25 mm from that surface or edge in direct contact with a flat phantom, to address interactive hand use exposure conditions. When hotspot mode applies, 10-g extremity SAR is required only for the surfaces and edges with hotspot mode 1-g reported SAR > 1.2 W/kg; however, when power reduction applies to hotspot mode the measured SAR must be scaled to the maximum output power, including tolerance, allowed for phablet modes to compare with the 1.2 W/kg SAR test reduction threshold.

**KDB 941225 D01 SAR test for 3G devices:**

When the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤ ¼ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode.

**KDB 941225 D05 SAR for LTE Devices:**

SAR test reduction is applied using the following criteria:

- Start with the largest channel bandwidth and measure SAR for QPSK with 1 RB, and 50% RB allocation, using the RB offset and required test channel combination with the highest maximum output power among RB offsets at the upper edge, middle and lower edge of each required test channel.
- When the reported SAR is > 0.8 W/kg, testing for other Channels 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.
- For LTE bands that do not support at least three non-overlapping channels in certain channel bandwidths, test the available non-overlapping channels instead. 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; therefore, the requirement for H, M and L channels may not fully apply.


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**KDB 248227 D01 SAR meas for 802.11:**

SAR test reduction for 802.11 Wi-Fi transmission mode configurations are considered separately for DSSS and OFDM. An initial test position is determined to reduce the number of tests required for certain exposure configurations with multiple test positions. An initial test configuration is determined for each frequency band and aggregated band according to maximum output power, channel bandwidth, wireless mode configurations and other operating parameters to streamline the measurement requirements. For 2.4 GHz DSSS, either the initial test position or DSSS procedure is applied to reduce the number of SAR tests; these are mutually exclusive. For OFDM, an initial test position is only applicable to next to the ear, UMPC mini-tablet and hotspot mode configurations, which is tested using the initial test configuration to facilitate test reduction. For other exposure conditions with a fixed test position, SAR test reduction is determined using only the initial test configuration.

The multiple test positions require SAR measurements in head, hotspot mode or UMPC mini-tablet configurations may be reduced according to the highest reported SAR determined using the initial test position(s) by applying the DSSS or OFDM SAR measurement procedures in the required wireless mode test configuration(s). The initial test position(s) is measured using the highest measured maximum output power channel in the required wireless mode test configuration(s). Initial Test Position SAR Test Reduction Procedure is outlined in KDB 248227 D01 §5.1.1. To determine the initial test position, Area Scans were performed to determine the position with the Maximum Value of SAR (measured). The position that produced the highest Maximum Value of SAR is considered the worst case position; thus used as the initial test position.



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## 10.1. GSM850

| RF Exposure Conditions | Mode | Power Back-off | Dist. (mm) | Test Position | Ch #. | Freq. (MHz) | Power (dBm) | | 1-g SAR (W/kg) | | Plot No. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Tune-up Limit | Meas. | Meas. | Scaled | |
| Head | GPRS 4 Slots | OFF | 0 | Left Touch | 190 | 836.6 | 28.0 | 27.3 | 0.037 | 0.043 | |
| | | | | Left Tilt | 190 | 836.6 | 28.0 | 27.3 | 0.017 | 0.020 | |
| | | | | Right Touch | 190 | 836.6 | 28.0 | 27.3 | 0.047 | **0.055** | 1 |
| | | | | Right Tilt | 190 | 836.6 | 28.0 | 27.3 | 0.019 | 0.022 | |
| Body-worn | GPRS 4 Slots | OFF | 15 | Rear | 190 | 836.6 | 28.0 | 27.3 | 0.081 | **0.095** | 2 |
| | | | | Front | 190 | 836.6 | 28.0 | 27.3 | 0.027 | 0.032 | |
| Hotspot | GPRS 4 Slots | OFF | 10 | Rear | 190 | 836.6 | 28.0 | 27.3 | 0.175 | **0.206** | 3 |
| | | | | Front | 190 | 836.6 | 28.0 | 27.3 | 0.028 | 0.033 | |
| | | | | Edge 2 | 190 | 836.6 | 28.0 | 27.3 | 0.040 | 0.047 | |
| | | | | Edge 3 | 190 | 836.6 | 28.0 | 27.3 | 0.042 | 0.049 | |
| | | | | Edge 4 | 190 | 836.6 | 28.0 | 27.3 | 0.015 | 0.018 | |

## 10.2. GSM1900

| RF Exposure Conditions | Mode | Power Back-off | Dist. (mm) | Test Position | Ch #. | Freq. (MHz) | Power (dBm) | | 1-g SAR (W/kg) | | Plot No. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Tune-up Limit | Meas. | Meas. | Scaled | |
| Head | GPRS 4 Slots | OFF | 0 | Left Touch | 661 | 1880.0 | 25.0 | 24.4 | 0.058 | 0.067 | |
| | | | | Left Tilt | 661 | 1880.0 | 25.0 | 24.4 | 0.043 | 0.049 | |
| | | | | Right Touch | 661 | 1880.0 | 25.0 | 24.4 | 0.083 | **0.095** | 4 |
| | | | | Right Tilt | 661 | 1880.0 | 25.0 | 24.4 | 0.036 | 0.041 | |
| Body-worn | GPRS 4 Slots | OFF | 15 | Rear | 661 | 1880.0 | 25.0 | 24.4 | 0.056 | **0.064** | 5 |
| | | | | Front | 661 | 1880.0 | 25.0 | 24.4 | 0.048 | 0.055 | |
| Hotspot | GPRS 4 Slots | ON | 10 | Rear | 661 | 1880.0 | 23.0 | 23.0 | 0.101 | 0.101 | |
| | | | | Front | 661 | 1880.0 | 23.0 | 23.0 | 0.132 | **0.132** | 6 |
| | | | | Edge 2 | 661 | 1880.0 | 23.0 | 23.0 | 0.106 | 0.106 | |
| | | | | Edge 3 | 661 | 1880.0 | 23.0 | 23.0 | 0.091 | 0.091 | |
| | | | | Edge 4 | 661 | 1880.0 | 23.0 | 23.0 | 0.039 | 0.039 | |

**Note(s):**

Hotspot mode supports power reduction. When the measured SAR is scaled to the maximum tune-up limit, the adjusted SAR is < 1.2 W/kg. Therefore, Product Specific 10g SAR testing is not required for this band in accordance with KDB 648474 §2.5 b.


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## 10.3. W-CDMA Band II

| RF Exposure Conditions | Mode | Power Back-off | Dist. (mm) | Test Position | Ch #. | Freq. (MHz) | Power (dBm) | | 1-g SAR (W/kg) | | Plot No. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Tune-up Limit | Meas. | Meas. | Scaled | |
| Head | Rel 99 RMC 12.2 kbps | OFF | 0 | Left Touch | 9262 | 1852.4 | 25.0 | 24.8 | 0.157 | 0.164 | |
| | | | | Left Tilt | 9262 | 1852.4 | 25.0 | 24.8 | 0.140 | 0.147 | |
| | | | | Right Touch | 9262 | 1852.4 | 25.0 | 24.8 | 0.220 | **0.230** | 7 |
| | | | | Right Tilt | 9262 | 1852.4 | 25.0 | 24.8 | 0.134 | 0.140 | |
| Body-worn | Rel 99 RMC 12.2 kbps | OFF | 15 | Rear | 9262 | 1852.4 | 25.0 | 24.8 | 0.239 | **0.250** | 8 |
| | | | | Front | 9262 | 1852.4 | 25.0 | 24.8 | 0.200 | 0.209 | |
| Hotspot | Rel 99 RMC 12.2 kbps | ON | 10 | Rear | 9400 | 1880.0 | 23.0 | 22.1 | 0.410 | **0.509** | 9 |
| | | | | Front | 9400 | 1880.0 | 23.0 | 22.1 | 0.264 | 0.328 | |
| | | | | Edge 2 | 9400 | 1880.0 | 23.0 | 22.1 | 0.262 | 0.325 | |
| | | | | Edge 3 | 9400 | 1880.0 | 23.0 | 22.1 | 0.217 | 0.269 | |
| | | | | Edge 4 | 9400 | 1880.0 | 23.0 | 22.1 | 0.105 | 0.130 | |

**Note(s):**

Hotspot mode supports power reduction. When the measured SAR is scaled to the maximum tune-up limit, the adjusted SAR is < 1.2 W/kg. Therefore, Product Specific 10g SAR testing is not required for this band in accordance with KDB 648474 §2.5 b.

## 10.4. W-CDMA Band V

| RF Exposure Conditions | Mode | Power Back-off | Dist. (mm) | Test Position | Ch #. | Freq. (MHz) | Power (dBm) | | 1-g SAR (W/kg) | | Plot No. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Tune-up Limit | Meas. | Meas. | Scaled | |
| Head | Rel 99 RMC 12.2 kbps | OFF | 0 | Left Touch | 4183 | 836.6 | 25.0 | 23.2 | 0.068 | 0.103 | |
| | | | | Left Tilt | 4183 | 836.6 | 25.0 | 23.2 | 0.035 | 0.053 | |
| | | | | Right Touch | 4183 | 836.6 | 25.0 | 23.2 | 0.083 | **0.126** | 10 |
| | | | | Rightt Tilt | 4183 | 836.6 | 25.0 | 23.2 | 0.033 | 0.050 | |
| Body-worn | Rel 99 RMC 12.2 kbps | OFF | 15 | Rear | 4183 | 836.6 | 25.0 | 23.2 | 0.114 | **0.173** | 11 |
| | | | | Front | 4183 | 836.6 | 25.0 | 23.2 | 0.055 | 0.083 | |
| Hotspot | Rel 99 RMC 12.2 kbps | OFF | 10 | Rear | 4183 | 836.6 | 25.0 | 23.2 | 0.265 | **0.401** | 12 |
| | | | | Front | 4183 | 836.6 | 25.0 | 23.2 | 0.059 | 0.089 | |
| | | | | Edge 2 | 4183 | 836.6 | 25.0 | 23.2 | 0.079 | 0.120 | |
| | | | | Edge 3 | 4183 | 836.6 | 25.0 | 23.2 | 0.079 | 0.120 | |
| | | | | Edge 4 | 4183 | 836.6 | 25.0 | 23.2 | 0.029 | 0.044 | |


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## 10.5. CDMA BC0

| RF Exposure Conditions | Mode | Power Back-off | Dist. (mm) | Test Position | Ch #. | Freq. (MHz) | Power (dBm) | | 1-g SAR (W/kg) | | Plot No. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Tune-up Limit | Meas. | Meas. | Scaled | |
| Head | 1xRTT RC3 SO55 | OFF | 0 | Left Touch | 384 | 836.5 | 26.0 | 25.2 | 0.104 | 0.126 | |
| | | | | Left Tilt | 384 | 836.5 | 26.0 | 25.2 | 0.050 | 0.061 | |
| | | | | Right Touch | 384 | 836.5 | 26.0 | 25.2 | 0.124 | **0.151** | 13 |
| | | | | Rightt Tilt | 384 | 836.5 | 26.0 | 25.2 | 0.050 | 0.061 | |
| Head | 1xEVDO Rel.0 | OFF | 0 | Left Touch | 384 | 836.5 | 26.0 | 25.2 | 0.112 | 0.136 | |
| | | | | Left Tilt | 384 | 836.5 | 26.0 | 25.2 | 0.055 | 0.067 | |
| | | | | Right Touch | 384 | 836.5 | 26.0 | 25.2 | 0.133 | **0.162** | 14 |
| | | | | Right Tilt | 384 | 836.5 | 26.0 | 25.2 | 0.055 | 0.067 | |
| Body-worn | 1xRTT RC3 SO32 | OFF | 15 | Rear | 384 | 836.5 | 26.0 | 25.1 | 0.150 | **0.183** | 15 |
| | | | | Front | 384 | 836.5 | 26.0 | 25.1 | 0.076 | 0.093 | |
| Hotspot | 1xRTT RC3 SO32 | OFF | 10 | Rear | 384 | 836.5 | 26.0 | 25.1 | 0.459 | **0.561** | 16 |
| | | | | Front | 384 | 836.5 | 26.0 | 25.1 | 0.091 | 0.111 | |
| | | | | Edge 2 | 384 | 836.5 | 26.0 | 25.1 | 0.134 | 0.164 | |
| | | | | Edge 3 | 384 | 836.5 | 26.0 | 25.1 | 0.136 | 0.166 | |
| | | | | Edge 4 | 384 | 836.5 | 26.0 | 25.1 | 0.044 | 0.054 | |

## 10.6. LTE Band 5 (10MHz Bandwidth)

| RF Exposure Conditions | Mode | Power Back-off | Dist. (mm) | Test Position | Ch #. | Freq. (MHz) | RB Allocation | RB offest | Power (dBm) | | 1-g SAR (W/kg) | | Plot No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Tune-up Limit | Meas. | Meas. | Scaled | |
| Head | QPSK | OFF | 0 | Left Touch | 20525 | 836.5 | 1 | 0 | 25.0 | 23.7 | 0.060 | 0.081 | |
| | | | | | | | 25 | 0 | 24.0 | 22.8 | 0.050 | 0.066 | |
| | | | | Left Tilt (15°) | 20525 | 836.5 | 1 | 0 | 25.0 | 23.7 | 0.033 | 0.045 | |
| | | | | | | | 25 | 0 | 24.0 | 22.8 | 0.025 | 0.033 | |
| | | | | Right Touch | 20525 | 836.5 | 1 | 0 | 25.0 | 23.7 | 0.075 | **0.101** | 17 |
| | | | | | | | 25 | 0 | 24.0 | 22.8 | 0.062 | 0.082 | |
| | | | | Right Tilt (15°) | 20525 | 836.5 | 1 | 0 | 25.0 | 23.7 | 0.031 | 0.042 | |
| | | | | | | | 25 | 0 | 24.0 | 22.8 | 0.025 | 0.033 | |
| Body-worn | QPSK | OFF | 15 | Rear | 20525 | 836.5 | 1 | 0 | 25.0 | 23.7 | 0.126 | **0.170** | 18 |
| | | | | | | | 25 | 0 | 24.0 | 22.8 | 0.103 | 0.136 | |
| | | | | Front | 20525 | 836.5 | 1 | 0 | 25.0 | 23.7 | 0.053 | 0.071 | |
| | | | | | | | 25 | 0 | 24.0 | 22.8 | 0.042 | 0.055 | |
| Hotspot | QPSK | OFF | 10 | Rear | 20525 | 836.5 | 1 | 0 | 25.0 | 23.7 | 0.288 | **0.389** | 19 |
| | | | | | | | 25 | 0 | 24.0 | 22.8 | 0.236 | 0.311 | |
| | | | | Front | 20525 | 836.5 | 1 | 0 | 25.0 | 23.7 | 0.052 | 0.070 | |
| | | | | | | | 25 | 0 | 24.0 | 22.8 | 0.042 | 0.055 | |
| | | | | Edge 2 | 20525 | 836.5 | 1 | 0 | 25.0 | 23.7 | 0.082 | 0.111 | |
| | | | | | | | 25 | 0 | 24.0 | 22.8 | 0.065 | 0.086 | |
| | | | | Edge 3 | 20525 | 836.5 | 1 | 0 | 25.0 | 23.7 | 0.074 | 0.100 | |
| | | | | | | | 25 | 0 | 24.0 | 22.8 | 0.062 | 0.082 | |
| | | | | Edge 4 | 20525 | 836.5 | 1 | 0 | 25.0 | 23.7 | 0.033 | 0.045 | |
| | | | | | | | 25 | 0 | 24.0 | 22.8 | 0.027 | 0.036 | |


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## 10.7. LTE Band 41 (20MHz Bandwidth)

| RF Exposure Conditions | Mode | Power Back-off | Dist. (mm) | Test Position | Ch #. | Freq. (MHz) | RB Allocation | RB offest | Power (dBm) | | 1-g SAR (W/kg) | | Plot No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Tune-up Limit | Meas. | Meas. | Scaled | |
| Head | QPSK | OFF | 0 | Left Touch | 40740 | 2605.0 | 1 | 0 | 24.5 | 23.9 | 0.103 | 0.118 | |
| | | | | | | | 50 | 0 | 23.5 | 22.9 | 0.088 | 0.101 | |
| | | | | Left Tilt | 40740 | 2605.0 | 1 | 0 | 24.5 | 23.9 | 0.038 | 0.044 | |
| | | | | | | | 50 | 0 | 23.5 | 22.9 | 0.030 | 0.034 | |
| | | | | Right Touch | 40740 | 2605.0 | 1 | 0 | 24.5 | 23.9 | 0.251 | **0.288** | 20 |
| | | | | | | | 50 | 0 | 23.5 | 22.9 | 0.211 | 0.242 | |
| | | | | Right Tilt | 40740 | 2605.0 | 1 | 0 | 24.5 | 23.9 | 0.079 | 0.091 | |
| | | | | | | | 50 | 0 | 23.5 | 22.9 | 0.066 | 0.076 | |
| Body-worn | QPSK | OFF | 15 | Rear | 40740 | 2605.0 | 1 | 0 | 24.5 | 23.9 | 0.200 | **0.230** | 21 |
| | | | | | | | 50 | 0 | 23.5 | 22.9 | 0.162 | 0.186 | |
| | | | | Front | 40740 | 2605.0 | 1 | 0 | 24.5 | 23.9 | 0.047 | 0.054 | |
| | | | | | | | 50 | 0 | 23.5 | 22.9 | 0.038 | 0.044 | |
| Hotspot | QPSK | OFF | 10 | Rear | 40740 | 2605.0 | 1 | 0 | 24.5 | 23.9 | 0.421 | **0.483** | 22 |
| | | | | | | | 50 | 0 | 23.5 | 22.9 | 0.348 | 0.400 | |
| | | | | Front | 40740 | 2605.0 | 1 | 0 | 24.5 | 23.9 | 0.094 | 0.108 | |
| | | | | | | | 50 | 0 | 23.5 | 22.9 | 0.075 | 0.086 | |
| | | | | Edge 1 | 40740 | 2605.0 | 1 | 0 | 24.5 | 23.9 | 0.031 | 0.036 | |
| | | | | | | | 50 | 0 | 23.5 | 22.9 | 0.023 | 0.026 | |
| | | | | Edge 2 | 40740 | 2605.0 | 1 | 0 | 24.5 | 23.9 | 0.013 | 0.015 | |
| | | | | | | | 50 | 0 | 23.5 | 22.9 | 0.008 | 0.010 | |
| | | | | Edge 4 | 40740 | 2605.0 | 1 | 0 | 24.5 | 23.9 | 0.196 | 0.225 | |
| | | | | | | | 50 | 0 | 23.5 | 22.9 | 0.164 | 0.188 | |

### LTE UL CA_41C Measured Results

| RF Exposure Conditions | Mode | Power Back-off | Dist. (mm) | Test Position | PCC UL | | | | SCC UL | | | | Power (dBm) | | 1-g SAR (W/kg) | | Plot No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Ch #. | Freq. (MHz) | RB Allocation | RB offest | Ch #. | Freq. (MHz) | RB Allocation | RB offest | Tune-up limit | Meas. | Meas. | Scaled | |
| Head | QPSK | OFF | 0 | Right Touch | 40521 | 2583.1 | 1 | 99 | 40719 | 2602.9 | 1 | 0 | 24.5 | 24.4 | 0.437 | **0.447** | 23 |
| Body-worn | QPSK | OFF | 15 | Rear | 40521 | 2583.1 | 1 | 99 | 40719 | 2602.9 | 1 | 0 | 24.5 | 24.4 | 0.123 | **0.126** | 24 |
| Hotspot | QPSK | OFF | 10 | Rear | 40521 | 2583.1 | 1 | 99 | 40719 | 2602.9 | 1 | 0 | 24.5 | 24.4 | 0.280 | **0.287** | 25 |


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## 10.8. Wi-Fi (DTS Band)

When the 802.11b reported SAR of the highest measured maximum output power channel is ≤ 0.8 W/kg, no further SAR testing is required. If SAR is > 0.8 W/kg and ≤ 1.2 W/kg, SAR is required for the next highest measured output power channel. Finally, if SAR is > 1.2 W/kg, SAR is required for the third channel.
SAR testing is not required for OFDM mode(s) when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.

| RF Exposure Conditions | Mode | Power Back-off | Dist. (mm) | Test Position | Ch #. | Freq. (MHz) | Duty Cycle | Area Scan Max. SAR (W/kg) | Power (dBm) | | 1-g SAR (W/kg) | | Plot No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Tune-up Limit | Meas. | Meas. | Scaled | |
| Head | 802.11b 1 Mbps | ON | 0 | Left Touch | 6 | 2437 | 98.47% | 0.076 | 14.0 | 14.0 | | | |
| | | | | Left Tilt | 6 | 2437 | 98.47% | **0.100** | 14.0 | 14.0 | 0.065 | **0.066** | 26 |
| | | | | Right Touch | 6 | 2437 | 98.47% | 0.076 | 14.0 | 14.0 | | | |
| | | | | Right Tilt | 6 | 2437 | 98.47% | 0.090 | 14.0 | 14.0 | | | |
| Body-worn | 802.11b 1 Mbps | OFF | 15 | Rear | 6 | 2437 | 98.47% | **0.134** | 19.0 | 19.0 | 0.093 | **0.094** | 27 |
| | | | | Front | 6 | 2437 | 98.47% | 0.026 | 19.0 | 19.0 | | | |
| Hotspot | 802.11b 1 Mbps | OFF | 10 | Rear | 6 | 2437 | 98.47% | **0.313** | 19.0 | 19.0 | 0.235 | **0.239** | 28 |
| | | | | Front | 6 | 2437 | 98.47% | 0.051 | 19.0 | 19.0 | | | |
| | | | | Edge 1 | 6 | 2437 | 98.47% | 0.113 | 19.0 | 19.0 | | | |
| | | | | Edge 2 | 6 | 2437 | 98.47% | 0.039 | 19.0 | 19.0 | | | |


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# 10.9. Wi-Fi (U-NII Band)

## UNII-1 &2A

When the specified maximum output power is the same for both UNII band I and UNII band 2A, begin SAR measurement in UNII band 2A; and if the highest *reported* SAR for UNII band 2A is

- ≤ 1.2 W/kg, SAR is not required for UNII band I
- > 1.2 W/kg, both bands should be tested independently for SAR.

| RF Exposure Conditions | Mode | Power Back-off | Dist. (mm) | Test Position | Ch #. | Freq. (MHz) | Duty Cycle | Area Scan Max. SAR (W/kg) | Power (dBm) | | 1-g SAR (W/kg) | | Plot No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Tune-up Limit | Meas. | Meas. | Scaled | |
| Head | 802.11ac (VHT80) | ON | 0 | Left Touch | 58 | 5290 | 90.14% | 0.301 | 11.0 | 11.0 | | | |
| | | | | Left Tilt | 58 | 5290 | 90.14% | **0.382** | 11.0 | 11.0 | 0.168 | **0.186** | 29 |
| | | | | Right Touch | 58 | 5290 | 90.14% | 0.209 | 11.0 | 11.0 | | | |
| | | | | Right Tilt | 58 | 5290 | 90.14% | 0.276 | 11.0 | 11.0 | | | |
| Body-worn | 802.11n HT20 | OFF | 15 | Rear | 60 | 5300 | 97.39% | **1.140** | 19.0 | 19.0 | 0.557 | **0.572** | 30 |
| | | | | Front | 60 | 5300 | 97.39% | 0.244 | 19.0 | 19.0 | 0.102 | 0.105 | |
| RF Exposure Conditions | Mode | Power Back-off | Dist. (mm) | Test Position | Ch #. | Freq. (MHz) | Duty Cycle | Area Scan Max. SAR (W/kg) | Power (dBm) | | 10-g SAR (W/kg) | | Plot No. |
| | | | | | | | | | Tune-up Limit | Meas. | Meas. | Scaled | |
| Product Specific 10g | 802.11n HT20 | OFF | 0 | Rear | 56 | 5280 | 97.39% | 28.300 | 19.0 | 19.0 | 2.460 | 2.526 | |
| | | | | | 60 | 5300 | 97.39% | **31.200** | 19.0 | 19.0 | 2.890 | **2.967** | 31 |
| | | | | Front | 60 | 5300 | 97.39% | 1.910 | 19.0 | 19.0 | | | |
| | | | | Edge 1 | 60 | 5300 | 97.39% | 14.500 | 19.0 | 19.0 | 1.300 | 1.335 | |
| | | | | Edge 2 | 60 | 5300 | 97.39% | 0.804 | 19.0 | 19.0 | | | |

**Note(s):**

Reported SAR for UNII-2A is < 1.2 W/kg and 3.0 W/kg (Product Specific 10g), therefore SAR is not required for UNII-1.

## UNII-2C

| RF Exposure Conditions | Mode | Power Back-off | Dist. (mm) | Test Position | Ch #. | Freq. (MHz) | Duty Cycle | Area Scan Max. SAR (W/kg) | Power (dBm) | | 1-g SAR (W/kg) | | Plot No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Tune-up Limit | Meas. | Meas. | Scaled | |
| Head | 802.11ac (VHT80) | ON | 0 | Left Touch | 122 | 5610 | 90.14% | 0.159 | 11.0 | 11.0 | | | |
| | | | | Left Tilt | 122 | 5610 | 90.14% | **0.221** | 11.0 | 11.0 | 0.120 | **0.133** | 32 |
| | | | | Right Touch | 122 | 5610 | 90.14% | 0.153 | 11.0 | 11.0 | | | |
| | | | | Right Tilt | 122 | 5610 | 90.14% | 0.185 | 11.0 | 11.0 | | | |
| Body-worn | 802.11n HT20 | OFF | 15 | Rear | 116 | 5580 | 97.39% | **1.120** | 19.0 | 19.0 | 0.565 | **0.580** | 33 |
| | | | | Front | 116 | 5580 | 97.39% | 0.211 | 19.0 | 19.0 | 0.105 | 0.108 | |
| RF Exposure Conditions | Mode | Power Back-off | Dist. (mm) | Test Position | Ch #. | Freq. (MHz) | Duty Cycle | Area Scan Max. SAR (W/kg) | Power (dBm) | | 10-g SAR (W/kg) | | Plot No. |
| | | | | | | | | | Tune-up Limit | Meas. | Meas. | Scaled | |
| Product Specific 10g | 802.11n HT20 | OFF | 0 | Rear | 100 | 5500 | 97.39% | 14.800 | 19.0 | 19.0 | 2.080 | 2.136 | |
| | | | | | 116 | 5580 | 97.39% | **16.100** | 19.0 | 19.0 | 2.260 | **2.321** | 34 |
| | | | | Front | 116 | 5580 | 97.39% | 1.460 | 19.0 | 19.0 | | | |
| | | | | Edge 1 | 100 | 5500 | 97.39% | 9.480 | 19.0 | 19.0 | 0.932 | 0.957 | |
| | | | | | 116 | 5580 | 97.39% | 10.500 | 19.0 | 19.0 | 0.994 | 1.021 | |
| | | | | Edge 2 | 116 | 5580 | 97.39% | 0.480 | 19.0 | 19.0 | | | |


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**UNII-3**

| RF Exposure Conditions | Mode | Power Back-off | Dist. (mm) | Test Position | Ch #. | Freq. (MHz) | Duty Cycle | Area Scan Max. SAR (W/kg) | Power (dBm) | | 1-g SAR (W/kg) | | Plot No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Tune-up Limit | Meas. | Meas. | Scaled | |
| Head | 802.11ac VHT80 | ON | 0 | Left Touch | 155 | 5775 | 90.14% | 0.143 | 11.0 | 11.0 | | | |
| | | | | Left Tilt | 155 | 5775 | 90.14% | 0.181 | 11.0 | 11.0 | 0.092 | **0.102** | 35 |
| | | | | Right Touch | 155 | 5775 | 90.14% | 0.159 | 11.0 | 11.0 | | | |
| | | | | Right Tilt | 155 | 5775 | 90.14% | **0.213** | 11.0 | 11.0 | 0.085 | 0.094 | |
| Body-worn | 802.11n HT20 | OFF | 15 | Rear | 157 | 5785 | 97.39% | **0.830** | 19.0 | 19.0 | 0.370 | **0.380** | 36 |
| | | | | Front | 157 | 5785 | 97.39% | 0.135 | 19.0 | 19.0 | | | |
| Hotspot | 802.11n HT20 | OFF | 10 | Rear | 157 | 5785 | 97.39% | **1.080** | 19.0 | 19.0 | 0.531 | **0.545** | 37 |
| | | | | Front | 157 | 5785 | 97.39% | 0.238 | 19.0 | 19.0 | | | |
| | | | | Edge 1 | 157 | 5785 | 97.39% | 0.871 | 19.0 | 19.0 | 0.400 | 0.411 | |
| | | | | Edge 2 | 157 | 5785 | 97.39% | 0.124 | 19.0 | 19.0 | | | |

## 10.10. Bluetooth

| RF Exposure Conditions | Mode | Power Back-off | Dist. (mm) | Test Position | Ch #. | Freq. (MHz) | Power (dBm) | | 1-g SAR (W/kg) | | Plot No. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Tune-up Limit | Meas. | Meas. | Scaled | |
| Head | GFSK | OFF | 0 | Left Touch | 39 | 2441 | 12.0 | 12.0 | 0.014 | 0.014 | |
| | | | | Left Tilt | 39 | 2441 | 12.0 | 12.0 | 0.016 | 0.016 | |
| | | | | Right Touch | 39 | 2441 | 12.0 | 12.0 | 0.011 | 0.011 | |
| | | | | Right Tilt | 39 | 2441 | 12.0 | 12.0 | 0.017 | **0.017** | 38 |
| Body-worn | GFSK | OFF | 15 | Rear | 39 | 2441 | 12.0 | 12.0 | 0.001 | **0.001** | 39 |
| | | | | Front | 39 | 2441 | 12.0 | 12.0 | - | - | |
| Hotspot | GFSK | OFF | 10 | Rear | 39 | 2441 | 12.0 | 12.0 | 0.012 | **0.012** | 40 |
| | | | | Front | 39 | 2441 | 12.0 | 12.0 | 0.004 | 0.004 | |
| | | | | Edge 1 | 39 | 2441 | 12.0 | 12.0 | 0.008 | 0.008 | |
| | | | | Edge 2 | 39 | 2441 | 12.0 | 12.0 | 0.002 | 0.002 | |

**Notes:**

1. For results listed with "-", the SAR result is less than 0.01 W/kg.


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# 11. SAR Measurement Variability

In accordance with published RF Exposure KDB 865664 D01 SAR measurement 100 MHz to 6 GHz. 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 <0.8 or 2 W/kg (1-g or 10-g respectively); steps 2) through 4) do not apply.
2) When the original highest measured SAR is ≥ 0.8 or 2 W/kg (1-g or 10-g respectively), 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 or 3.6 W/kg (~ 10% from the 1-g or 10-g respective SAR limit).
4) Perform a third repeated measurement only if the original, first, or second repeated measurement is ≥ 1.5 or 3.75 W/kg (1-g or 10-g respectively) and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

**Conclusion for 1-g SAR:**

Repeated measurements are not required since the original highest measured SAR is <0.8 W/kg(1-g).

| Frequency Band (MHz) | Air Interface | RF Exposure Conditions | Test Position | Repeated SAR (Yes/No) | Highest Measured SAR (W/kg) | First Repeated | |
|---|---|---|---|---|---|---|---|
| | | | | | | Measured SAR (W/kg) | Largest to Smallest SAR Ratio |
| 5300 | Wi-Fi 802.11a/n/ac | Product Specific 10g | Rear | Yes | 2.890 | 2.89 | 1.00 |
| 5500 | Wi-Fi 802.11a/n/ac | Product Specific 10g | Rear | Yes | 2.260 | 2.13 | 1.06 |

**Note(s):**

Second Repeated Measurement is not required since the ratio of the largest to smallest SAR for the original and first repeated measurement is < 1.20.


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# 12. Simultaneous Transmission Conditions

| RF Exposure Condition | Item | Capable Transmit Configurations | | |
|---|---|---|---|---|
| Head<br>Body-w orn<br>Hotspot | 1 | GSM(Voice) | + | DTS |
| | 2 | GSM(Voice) | + | U-NII |
| | 3 | GSM(Voice) | + | BT |
| | 4 | GSM(GPRS/EDGE) | + | DTS |
| | 5 | GSM(GPRS/EDGE) | + | U-NII |
| | 6 | GSM(GPRS/EDGE) | + | BT |
| | 7 | W-CDMA | + | DTS |
| | 8 | W-CDMA | + | U-NII |
| | 9 | CDMA | + | DTS |
| | 10 | CDMA | + | U-NII |
| | 11 | CDMA | + | BT |
| | 12 | W-CDMA | + | BT |
| | 13 | LTE | + | DTS |
| | 14 | LTE | + | U-NII |
| | 15 | LTE | + | BT |

Notes:
1. DTS & UNII supports Hotspot.
2. GPRS/EDGE, W-CDMA, and LTE support Hotspot.
3. VoIP is supported in GPRS/EDGE, W-CDMA, and LTE.
4. DTS Radio cannot transmit simultaneously w ith Bluetooth Radio.
5. U-NII Radio cannot transmit simultaneously w ith Bluetooth Radio.

**Note(s):**
Product Specific 10g SAR does not require simultaneous transmission analysis.

## 12.1. Simultaneous transmission SAR test exclusion considerations

KDB 447498 D01 General RF Exposure Guidance provides two procedures for determining simultaneous transmission SAR test exclusion: Sum of SAR and SAR to Peak Location Ratio (SPLSR)

### 12.1.1. Sum of SAR

To qualify for simultaneous transmission SAR test exclusion based upon Sum of SAR the sum of the reported standalone SARs for all simultaneously transmitting antennas shall be below the applicable standalone SAR limit. If the sum of the SARs is above the applicable limit then simultaneous transmission SAR test exclusion may still apply if the requirements of the SAR to Peak Location Ratio (SPLSR) evaluation are met.

## 12.2. Sum of the SAR for WWAN & Wi-Fi & BT

| RF Exposure conditions | Standalone SAR (W/kg) | | | | ∑ 1-g SAR (W/kg) | | |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 1+2 | 1+3 | 1+4 |
| | WWAN | Wi-Fi 2.4G | Wi-Fi 5G | BT | | | |
| Head | 0.447 | 0.066 | 0.186 | 0.017 | **0.513** | **0.633** | **0.464** |
| Body-worn | 0.250 | 0.094 | 0.580 | 0.001 | **0.344** | **0.830** | **0.251** |
| Hotspot | 0.561 | 0.239 | 0.545 | 0.012 | **0.800** | **1.106** | **0.573** |

**Conclusion:**
Simultaneous transmission SAR measurement (Volume Scan) is not required because the sum of the 1-g SAR is < 1.6 W/kg.


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# Appendixes

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

**Appendix A: SAR Setup Photos**

**Appendix B: SAR System Check Plots**

**Appendix C: SAR Highest Test Plots**

**Appendix D: SAR Tissue Ingredients**

**Appendix E: SAR Probe Certificates**

**Appendix F: SAR Dipole Certificates**

**END OF REPORT**


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