



**SAR EVALUATION REPORT**

**IEEE Std 1528-2013**

*For*

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

**FCC ID: A3LSMA750G**

**Model Name: SM-A750G/DS, SM-A750G**

**Report Number: 12440720-S1V3**

**Issue Date: 9/20/2018**

*Prepared for*

**Samsung Electronics Co., Ltd.  
129 Samsung-Ro, Yeongtong-Gu,  
Suwon-Si, Gyeonggi-Do, 16677, Korea**

*Prepared by*

**UL VERIFICATION SERVICES INC.  
47173 BENICIA STREET  
FREMONT, CA 94538, U.S.A.  
TEL: (510) 771-1000  
FAX: (510) 661-0888**



NVLAP LAB CODE 200065-0

**Revision History**

Rev.	Date	Revisions	Revised By
V1	9/7/2018	Initial Issue	--
V2	9/10/2018	Removed Blank Page Added Section 6.6: WLAN Proximity Sensor Test Rationale	Coltyce Sanders
V3	9/20/2018	Section 6.1: Updated HW Version	Coltyce Sanders

**Table of Contents**

**1. Attestation of Test Results ..... 5**

**2. Test Specification, Methods and Procedures..... 6**

**3. Facilities and Accreditation ..... 6**

**4. SAR Measurement System & Test Equipment ..... 7**

    4.1. SAR Measurement System..... 7

    4.2. SAR Scan Procedures ..... 8

    4.3. Test Equipment..... 10

**5. Measurement Uncertainty..... 11**

**6. Device Under Test (DUT) Information ..... 12**

    6.1. DUT Description ..... 12

    6.2. Wireless Technologies..... 13

    6.3. General LTE SAR Test and Reporting Considerations..... 14

    6.4. LTE (TDD) Considerations..... 16

    6.5. LTE Carrier Aggregation ..... 17

    6.6. WLAN Proximity Sensor Test Rationale..... 17

**7. RF Exposure Conditions (Test Configurations)..... 18**

**8. Dielectric Property Measurements & System Check ..... 20**

    8.1. Dielectric Property Measurements ..... 20

    8.2. System Check..... 22

**9. Conducted Output Power Measurements..... 24**

    9.1. GSM ..... 24

    9.2. W-CDMA ..... 26

    9.3. LTE..... 32

    9.4. LTE Carrier Aggregation ..... 44

    9.5. Wi-Fi 2.4GHz (DTS Band) ..... 47

    9.6. Wi-Fi 5GHz (U-NII Bands)..... 48

    9.7. Bluetooth ..... 51

**10. Measured and Reported (Scaled) SAR Results..... 52**

    10.1. GSM850..... 54

    10.2. GSM1900..... 54

    10.3. W-CDMA Band II..... 54

    10.4. W-CDMA Band IV ..... 55

    10.5. W-CDMA Band V ..... 55

10.6. *LTE Band 2 (20MHz Bandwidth)* ..... 55

10.7. *LTE Band 4 (20MHz Bandwidth)* ..... 56

10.8. *LTE Band 5 (10MHz Bandwidth)* ..... 56

10.9. *LTE Band 12 (10MHz Bandwidth)* ..... 56

10.10. *LTE Band 13 (10MHz Bandwidth)* ..... 57

10.11. *LTE Band 17 (10MHz Bandwidth)* ..... 57

10.12. *LTE Band 41 (20MHz Bandwidth)* ..... 57

10.13. *LTE Band 66 (20MHz Bandwidth)* ..... 58

10.14. *Wi-Fi (DTS Band)* ..... 58

10.15. *Wi-Fi (U-NII Band)* ..... 59

10.16. *Bluetooth* ..... 60

10.17. *Standalone SAR Test Exclusion Considerations & Estimated SAR* ..... 61

**11. SAR Measurement Variability** ..... **62**

**12. Simultaneous Transmission Conditions** ..... **63**

    12.1. *Simultaneous transmission SAR test exclusion considerations* ..... 63

        12.1.1. *Sum of SAR* ..... 63

    12.2. *Sum of the SAR for WWAN & Wi-Fi & BT* ..... 63

**Appendixes** ..... **64**

    12440598-S1V1 *Appendix A: SAR Setup Photos* ..... 64

    12440598-S1V1 *Appendix B: SAR System Check Plots* ..... 64



    12440598-S1V1 *Appendix C: Highest SAR Test Plots* ..... 64

    12440598-S1V1 *Appendix D: SAR Liquid Tissue Ingredients* ..... 64

    12440598-S1V1 *Appendix E: SAR Probe Calibration Certificates* ..... 64

    12440598-S1V1 *Appendix F: SAR Dipole Calibration Certificates* ..... 64

# 1. Attestation of Test Results

Applicant Name		Samsung Electronics Co., Ltd.			
FCC ID		A3LSMA750G			
Model Name		SM-A750G/DS, SM-A750G			
Applicable Standards		FCC 47 CFR § 2.1093 Published RF exposure KDB procedures 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		0.620	0.478	0.551	0.254
Body-worn		0.467	0.237	0.247	N/A
Hotspot/Wi-Fi Direct/BT Tethering		0.923	0.524	0.566	N/A
Product specific 10g SAR		N/A	N/A	0.546	N/A
Simultaneous TX	Head	1.161	1.019	1.161	0.733
	Body-worn	0.714	0.704	0.714	0.607
	Hotspot/ Wi-Fi Direct/ BT Tethering	1.447	1.447	1.294	1.133
Date Tested		8/27/2018 to 8/31/2018			
Test Results		Pass			
<p>UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.</p> <p><b>Note:</b> The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government (NIST Handbook 150, Annex A). This report is written to support regulatory compliance of the applicable standards stated above.</p>					
Approved & Released By:			Prepared By:		
					
Dave Weaver Operations Leader UL Verification Services Inc.			Jason Kuo Laboratory Technician UL Verification Services Inc.		

## 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
- 941225 D07 UMPC Mini Tablet v01r02

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

- [TCB workshop](#) April 2015; Page 33, RF Exposure Procedures Update (Overlapping LTE Bands)
- [TCB workshop](#) October 2014; Page 37, RF Exposure Procedures Update (Other LTE Considerations)
- [TCB workshop](#) October 2015; Page 6, RF Exposure Procedures (KDB 941225 D05A)
- [TCB workshop](#) April 2016; Page 13, RF Exposure Procedures (LTE Carrier Aggregation for DL)
- [TCB workshop](#) April 2016; Page 22, RF Exposure Procedures (Phablet Procedures)
- [TCB workshop](#) October 2016; Page 7, RF Exposure Procedures (Bluetooth Duty Factor)
- [TCB workshop](#) October 2016; Page 18, RF Exposure Procedures (DUT Holder Perturbations)
- [TCB workshop](#) May 2017; Page 9, Broadband Liquid Above 3 GHz
- [TCB workshop](#) May 2017; Page 16, Bluetooth Tethering

## 3. Facilities and Accreditation

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

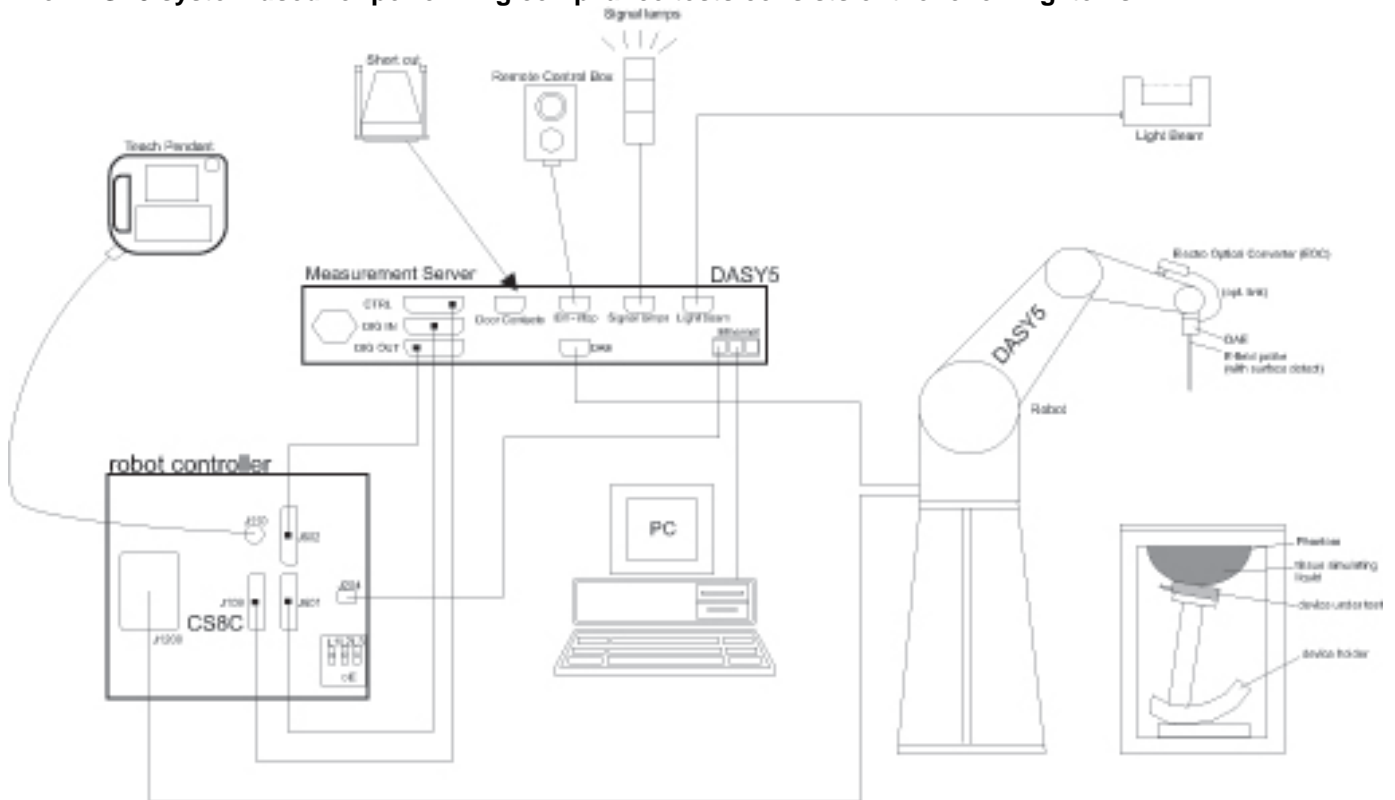
47173 Benicia Street	47266 Benicia Street
SAR Lab A	SAR Lab 1
SAR Lab B	SAR Lab 2
SAR Lab C	SAR Lab 3
SAR Lab D	SAR Lab 4
SAR Lab E	SAR Lab 5
SAR Lab F	SAR Lab 6
SAR Lab G	SAR Lab 7
SAR Lab H	SAR Lab 8

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

## 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.

## 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

	$\leq 3$ GHz	$> 3$ GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	$5 \pm 1$ mm	$\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5$ mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	$30^\circ \pm 1^\circ$	$20^\circ \pm 1^\circ$
Maximum area scan spatial resolution: $\Delta x_{Area}$ , $\Delta y_{Area}$	$\leq 2$ GHz: $\leq 15$ mm $2 - 3$ GHz: $\leq 12$ mm	$3 - 4$ GHz: $\leq 12$ mm $4 - 6$ GHz: $\leq 10$ 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 $\leq$ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	



**Step 3: Zoom Scan**

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

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

		≤ 3 GHz	> 3 GHz
Maximum zoom scan spatial resolution: $\Delta x_{Zoom}, \Delta y_{Zoom}$		$\leq 2$ GHz: $\leq 8$ mm $2 - 3$ GHz: $\leq 5$ mm*	$3 - 4$ GHz: $\leq 5$ mm* $4 - 6$ GHz: $\leq 4$ mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$	$\leq 5$ mm	$3 - 4$ GHz: $\leq 4$ mm $4 - 5$ GHz: $\leq 3$ mm $5 - 6$ GHz: $\leq 2$ mm
	graded grid	$\Delta z_{Zoom}(1)$ : between 1 <sup>st</sup> two points closest to phantom surface	$\leq 4$ 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	$\geq 30$ mm	$3 - 4$ GHz: $\geq 28$ mm $4 - 5$ GHz: $\geq 25$ mm $5 - 6$ GHz: $\geq 22$ mm
Note: $\delta$ 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 <i>reported</i> SAR from the <i>area scan based 1-g SAR estimation</i> procedures of KDB 447498 is $\leq 1.4$ W/kg, $\leq 8$ mm, $\leq 7$ mm and $\leq 5$ mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.			

**Step 4: Power drift measurement**

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

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

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

### 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.

#### Dielectric Property Measurements

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Vector Network Analyzer	R&S	ZNLE6	101274-MN	7/16/2019
Dielectric Probe kit	SPEAG	DAK-3.5	1082	10/17/2018
Shorting Block	SPEAG	DAK-3.5 Short	SM DAK 200 BA	10/17/2018
Thermometer	Fisher Scientific	Traceable	140562250	11/7/2018

#### System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Signal Generator	Agilent	N5181A	MY50140610	6/7/2019
Power Meter	Keysight	N1912A	MY55196007	7/23/2019
Power Sensor	Agilent	N1921A	MY53020038	4/23/2019
Power Sensor	Agilent	N1921A	MY5226009	1/8/2019
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1795093	N/A
Bi-directional coupler	Werlatone, Inc.	C8060-102	2149	N/A
DC Power Supply	HP	6296A	2841A-05955	N/A
Synthesized Signal Generator	Agilent	N5181A	MY50140630	5/25/2019
Power Meter	Agilent	N1912A	MY50001018	10/17/2019
Power Sensor	Agilent	N1921A	MY52270022	12/28/2018
Power Sensor	Agilent	N1912A	MY52200012	10/27/2018
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1795092	N/A
Bi-directional coupler	Werlatone, Inc.	C8060-102	2141	N/A
DC Power Supply	BK Precision	1611	215-02292	N/A

#### Lab Equipment

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
E-Field Probe (SAR Lab 5)	SPEAG	EX3DV4	7498	5/4/2019
E-Field Probe (SAR Lab 7)	SPEAG	EX3DV4	7500	5/4/2019
E-Field Probe (SAR Lab 8)	SPEAG	EX3DV4	7501	5/4/2019
Data Acquisition Electronics (SAR Lab 5)	SPEAG	DAE4	1546	5/3/2019
Data Acquisition Electronics (SAR Lab 7)	SPEAG	DAE4	1547	5/3/2019
Data Acquisition Electronics (SAR Lab 8)	SPEAG	DAE4	1258	5/22/2019
System Validation Dipole	SPEAG	D750V3	1071	11/21/2018
System Validation Dipole	SPEAG	D835V2	4d117	5/16/2019
System Validation Dipole	SPEAG	D1750V2	1077	10/5/2018
System Validation Dipole	SPEAG	D1900V2	5d163	10/5/2018
System Validation Dipole	SPEAG	D2450V2	899	3/16/2019
System Validation Dipole	SPEAG	D2600V2	1036	3/16/2019
System Validation Dipole	SPEAG	D5GHzV2	1003	3/13/2019
Thermometer (SAR Lab 5/7/8)	Fisher Scientific	Traceable	181062300	2/26/2019

#### Other

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Power Meter	Keysight	N1912A	MY55196015	3/1/2019
Power Sensor	Agilent	N1921A	MY53260010	10/17/2018
Base Station Simulator	R & S	R & S	137873-WG	6/1/2019
Base Station Simulator	R & S	R & S	137875-DZ	2/21/2019
PXA Spectrum Analyzer	Keysight	N9030A	MY53311010	2/3/2019

## 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  $\leq 30\%$ , 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.

## 6. Device Under Test (DUT) Information

### 6.1. DUT Description

Device Dimension	This is a Phablet Device (display diagonal dimension > 15.0 cm or an overall diagonal dimension > 16.0 cm) Refer to Appendix A		
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. <input checked="" type="checkbox"/> Mobile Hotspot (Wi-Fi 2.4 GHz) <input checked="" type="checkbox"/> Mobile Hotspot (Wi-Fi 5.8 GHz Channel 149 only)		
Wi-Fi Direct	Wi-Fi Direct enabled devices transfer data directly between each other <input checked="" type="checkbox"/> Wi-Fi Direct (Wi-Fi 2.4 GHz) <input checked="" type="checkbox"/> Wi-Fi Direct (Wi-Fi 5.2 GHz) <input checked="" type="checkbox"/> Wi-Fi Direct (Wi-Fi 5.8 GHz)		
Bluetooth Tethering	BT Tethering mode permits the device to share its cellular data connection with other devices. <input checked="" type="checkbox"/> BT Tethering (Bluetooth 2.4 GHz)		
Test sample information	<b>S/N</b>	<b>IMEI</b>	<b>Notes</b>
	R38K70KBTSH	351580100020037 351581100020035	WWAN Conducted
	R38K70KBTTV	351580100020045 351581100020043	WWAN Conducted
	R38K70KQGDH	359979090076524 359980090076522	WLAN Conducted
	R38K70MNRAD	359998090043144 359999090043142	SAR Radiated
	R38K70MNMLT	359998090041924 359999090041922	SAR Radiated
	R38K70MNSKR	359998090043565 359999090043563	SAR Radiated
	R38K70MNRBF	359998090043151 359999090043159	SAR Radiated
Hardware Version	REV1.2		
Software Version	A750GN.001		

## 6.2. Wireless Technologies

Wireless technologies	Frequency bands	Operating Mode		Duty Cycle used for SAR testing
GSM	850 1900	Voice (GMSK) GPRS (GMSK) EDGE (8PSK)	Multi-Slot Class: Class 33 - 4 Up, 5 Down	GPRS: 2 Slots: 25%
	Does this device support DTM (Dual Transfer Mode)? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			
W-CDMA (UMTS)	Band II Band IV Band V	UMTS Rel. 99 (Voice & Data) HSDPA (Rel. 9) HSUPA (Rel. 9) HSPA+ (Rel. 9) <sup>6</sup> DC-HSDPA (Rel. 9)		100%
LTE	FDD Band 2 FDD Band 4 FDD Band 5 FDD Band 12 FDD Band 13 FDD Band 17 TDD Band 41 FDD Band 66	QPSK 16QAM Rel. 10 Carrier Aggregation (1 Uplink and 2 Downlinks) <sup>5</sup>		100% (FDD) 63.3% (TDD) <sup>3</sup> Refer to §6.4
	Does this device support SV-LTE (1xRTT-LTE)? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			
Wi-Fi	2.4 GHz	802.11b 802.11g 802.11n (HT20)		802.11b <sup>1</sup> : 99.66%
	5 GHz	802.11a 802.11n (HT20) 802.11n (HT40) 802.11ac (VHT20) 802.11ac (VHT40) 802.11ac (VHT80)		802.11a <sup>2</sup> : 98.28% 802.11ac VHT80 <sup>2</sup> : 92.89%
		Does this device support bands 5.60 ~ 5.65 GHz? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		
	Does this device support Band gap channel(s)? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			
Bluetooth	2.4 GHz	Version 5.0 LE		GFSK <sup>3</sup> : 76.80%

**Notes:**

1. Refer to §9.5 for Duty Cycle Measurement
2. Refer to §9.6 for Duty Cycle Measurement
3. Refer to §9.7 for Duty Cycle Measurement
4. This device supports uplink-downlink configuration 0-6. The configuration with the highest duty cycle was used (Subframe Number 0 at 63.3%).
5. For supported Carrier Aggregation combinations, refer to §6.5.
6. Uplink 16QAM is not supported for HSPA+. Only downlink is supported.

### 6.3. General LTE SAR Test and Reporting Considerations

Item	Description						
Frequency range, Channel Bandwidth, Numbers and Frequencies	Band 2 <sup>3</sup>	Frequency range: 1850 - 1910 MHz (BW = 60 MHz)					
		Channel Bandwidth					
		20 MHz	15 MHz	10 MHz	5 MHz	3 MHz	1.4 MHz
	Low	18700 /1860	18675/ 1857.5	18650/ 1855	18625/ 1852.5	18615/ 1851.5	18607/ 1850.7
	Mid	18900/ 1880	18900/ 1880	18900/ 1880	18900/ 1880	18900/ 1880	18900/ 1880
	High	19100/ 1900	19125/ 1902.5	19150/ 1905	19175/ 1907.5	19185/ 1908.5	19193/ 1909.3
	Band 4 <sup>3</sup>	Frequency range: 1710 - 1755 MHz (BW = 45 MHz)					
		Channel Bandwidth					
		20 MHz <sup>2</sup>	15 MHz	10 MHz	5 MHz	3 MHz	1.4 MHz
	Low	20050/ 1720	20025/ 1717.5	20000/ 1715	19975/ 1712.5	19965/ 1711.5	19957/ 1710.7
	Mid	20175/ 1732.5	20175/ 1732.5	20175/ 1732.5	20175/ 1732.5	20175/ 1732.5	20175/ 1732.5
	High	20300/ 1745	20325/ 1747.5	20350/ 1750	20375/ 1752.5	20385/ 1753.5	20393/ 1754.3
	Band 5	Frequency range: 824 - 849 MHz (BW = 25 MHz)					
		Channel Bandwidth					
		20 MHz	15 MHz	10 MHz <sup>2</sup>	5 MHz	3 MHz	1.4 MHz
	Low			20450/ 829	20425/ 826.5	20415/ 825.5	20407/ 824.7
	Mid			20525/ 836.5	20525/ 836.5	20525/ 836.5	20525/ 836.5
	High			20600/ 844	20625/ 846.5	20635/ 847.5	20643/ 848.3
	Band 12	Frequency range: 699 – 716 MHz (BW = 17 MHz)					
		Channel Bandwidth					
		20 MHz	15 MHz	10 MHz <sup>2</sup>	5 MHz	3 MHz	1.4 MHz
	Low			23060/ 704	23035/ 701.5	23025/ 700.5	23017/ 699.7
	Mid			23095/ 707.5	23095/ 707.5	23095/ 707.5	23095/ 707.5
	High			23130/ 711	23155/ 713.5	23165/ 714.5	23173/ 715.3
	Band 13	Frequency range: 777 - 787 MHz (BW = 10 MHz)					
		Channel Bandwidth					
		20 MHz	15 MHz	10 MHz	5 MHz <sup>2</sup>	3 MHz	1.4 MHz
Low				23205/ 779.5			
Mid			23230/ 782	23230/ 782			
High				23255/ 784.5			
Band 17 <sup>3</sup>	Frequency range: 704 - 716 MHz (BW = 12 MHz)						
	Channel Bandwidth						
	20 MHz	15 MHz	10 MHz <sup>2</sup>	5 MHz <sup>2</sup>	3 MHz	1.4 MHz	
Low			23780/ 709	23755/ 706.5			
Mid			23790/ 710	23790/ 710			
High			23800/ 711	23825/ 713.5			

**General LTE SAR Test and Reporting Considerations (Continued)**

Frequency range, Channel Bandwidth, Numbers and Frequencies	Band 41 <sup>1</sup>	Frequency range: 2496 - 2690 MHz (BW = 194 MHz)																																																																		
		Channel Bandwidth																																																																		
		20 MHz	15 MHz	10 MHz	5 MHz	3 MHz	1.4 MHz																																																													
	Low	39750 / 2506.0																																																																		
	Low-Mid	40185 / 2549.5																																																																		
	Mid	40620 / 2593.0																																																																		
	Mid-High	41055 / 2636.5																																																																		
	High	41490 / 2680.0																																																																		
	Band 66	Frequency range: 1710 - 1780 MHz (BW = 70 MHz)																																																																		
		Channel Bandwidth																																																																		
		20 MHz	15 MHz	10 MHz	5 MHz	3 MHz	1.4 MHz																																																													
		Low	132072/ 1720	132047/ 1717.5	132022/ 1715	131997/ 1712.5	131987/ 1711.5	131979/ 1710.7																																																												
		Mid	132322/ 1745	132322/ 1745	132322/ 1745	132322/ 1745	132322/ 1745	132322/ 1745																																																												
High		132572/ 1770	132597/ 1772.5	132622/ 1775	132647/ 1777.5	132657/ 1778.5	132665/ 1779.3																																																													
LTE transmitter and antenna implementation	Refer to Appendix A.																																																																			
Maximum power reduction (MPR)	<p><b>Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 1, 2 and 3</b></p> <table border="1"> <thead> <tr> <th rowspan="2">Modulation</th> <th colspan="6">Channel bandwidth / Transmission bandwidth (N<sub>RB</sub>)</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> </thead> <tbody> <tr> <td>QPSK</td> <td>&gt; 5</td> <td>&gt; 4</td> <td>&gt; 8</td> <td>&gt; 12</td> <td>&gt; 16</td> <td>&gt; 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>&gt; 5</td> <td>&gt; 4</td> <td>&gt; 8</td> <td>&gt; 12</td> <td>&gt; 16</td> <td>&gt; 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>&gt; 5</td> <td>&gt; 4</td> <td>&gt; 8</td> <td>&gt; 12</td> <td>&gt; 16</td> <td>&gt; 18</td> <td>≤ 3</td> </tr> <tr> <td>256 QAM</td> <td colspan="6">≥ 1</td> <td>≤ 5</td> </tr> </tbody> </table> <p>MPR Built-in by design                      The manufacturer MPR values are always within the 3GPP maximum MPR allowance but may not follow the default MPR values.                      A-MPR (additional MPR) was disabled during SAR testing</p>						Modulation	Channel bandwidth / Transmission bandwidth (N <sub>RB</sub> )						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
Modulation	Channel bandwidth / Transmission bandwidth (N <sub>RB</sub> )							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																																																													
Power reduction	No																																																																			
Spectrum plots for RB configurations	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.																																																																			

**Notes:**

- LTE band 41 test channels in accordance with October 2014 TCB workshop for all channels bandwidths. This band was tested using Uplink-Downlink Configuration 0 at 63.3% duty cycle and Special Subframe 7.
- 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.
- LTE QPSK configuration has the highest maximum average output power per 3GPP standard.
  - LTE Band 4 (Frequency range: 1710-1755 MHz) is covered by LTE Band 66 (Frequency range: 1710-1780 MHz) due to similar frequency range, same maximum tune-up limit and same channel bandwidth.
  - LTE Band 17 (Frequency range: 704-716 MHz) is covered by LTE Band 12 (Frequency range: 699-716 MHz) due to overlapping frequency range, same maximum tune-up limit and same channel bandwidth.
- SAR Testing for LTE was performed with the same number of RB and RB offsets transmitting on all TTI frames (maximum TTI).

### 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	$26336 \cdot T_s$			$7680 \cdot T_s$		
5	$6592 \cdot T_s$	$(2+X) \cdot 2192 \cdot T_s$	$(2+X) \cdot 2560 \cdot T_s$	$20480 \cdot T_s$	$(2+X) \cdot 2192 \cdot T_s$	$(2+X) \cdot 2560 \cdot T_s$
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<sub>s</sub>) \* # 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 and Special Subframe 7.



### 6.5. LTE Carrier Aggregation

Combination	CA configuration	Bandwidth (MHz)											
		PCC						SCC1					
		20	15	10	5	3	1.4	20	15	10	5	3	1.4
Intra-Band contiguous	2C				√			√					
				√				√	√				
			√					√	√	√			
		√						√	√	√	√		
	41C				√			√					
				√				√	√				
			√					√	√	√			
	√						√	√	√	√			
Intra-Band non-contiguous	2A-2A	√	√	√	√			√	√	√	√		
	4A-4A	√	√	√	√			√	√	√	√		
	41A-41A	√	√	√	√			√	√	√	√		
Inter-Band non-contiguous	2A-12A	√	√	√	√					√	√	√	
	4A-17A			√	√					√	√		

**Note(s):**  
 For supported channels, please refer to §6.3.

### 6.6. WLAN Proximity Sensor Test Rationale

When a user makes or receives a voice or VOIP call, the audio of the call is sent through the earpiece at the top of the device so that the device can be used next to the ear. The IR Sensor located at the top of the device is used to detect when the device is in proximity of the user’s head in order to optimize the user’s device experience, for example, to dim or turn off the screen to save battery life. For this model, an auxiliary function of the IR sensor is for the purpose of RF Safety (i.e. reducing output power for Head SAR compliance).

A reduced power level of the device is called when the IR sensor is activated while in a held-to-ear voice/ VOIP call and the active audio receiver. Therefore, when the IR proximity sensor is active in a held-to-ear user scenario, the output power level is reduced.

## 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	No	1
			Edge 3 (Bottom)	< 25 mm	Yes	
	Product Specific 10g	0 mm	Edge 4 (Left)	< 25 mm	Yes	
			Rear	< 25 mm	Yes	2
			Front	< 25 mm	Yes	2
			Edge 1 (Top)	> 25 mm	No	1
			Edge 2 (Right)	> 25 mm	No	1
Edge 3 (Bottom)			< 25 mm	Yes	2	
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	No	1
			Edge 2 (Right)	< 25 mm	Yes	
			Edge 3 (Bottom)	< 25 mm	Yes	
	Product Specific 10g	0 mm	Edge 4 (Left)	> 25 mm	No	1
			Rear	< 25 mm	Yes	2
			Front	< 25 mm	Yes	2
			Edge 1 (Top)	> 25 mm	No	1
			Edge 2 (Right)	< 25 mm	Yes	2
Edge 3 (Bottom)			< 25 mm	Yes	2	
Edge 4 (Left)	> 25 mm	No	1			

**Notes:**

- SAR is not required because the distance from the antenna to the edge is > 25 mm as per KDB 941225 D06 Hot Spot SAR.
- 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.
- WWAN Main Ant. 2 supports LTE Band 41 only.
- Cellular Sub Antenna is Rx only.

**RF Exposure Conditions (Test Configurations) (continued):**

Wireless technologies	RF Exposure Conditions	DUT-to-User Separation	Test Position	Antenna-to-edge/surface	SAR Required	Note
WLAN & BT	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 / Wi-Fi Direct (2.4/5.2/5.8 GHz Bands)	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
	Product Specific 10g (2.4 GHz)	0 mm	Edge 4 (Left)	< 25 mm	Yes	
			Rear	< 25 mm	Yes	3
			Front	< 25 mm	Yes	3
			Edge 1 (Top)	< 25 mm	Yes	3
			Edge 2 (Right)	> 25 mm	No	1
			Edge 3 (Bottom)	> 25 mm	No	1
	Product Specific 10g (5 GHz Bands)	0 mm	Edge 4 (Left)	< 25 mm	Yes	3
			Rear	< 25 mm	Yes	2
			Front	< 25 mm	Yes	2
Edge 1 (Top)			< 25 mm	Yes	2	
Edge 2 (Right)			> 25 mm	No	1	
Edge 3 (Bottom)			> 25 mm	No	1	
			Edge 4 (Left)	< 25 mm	Yes	2

**Notes:**

- SAR is not required because the distance from the antenna to the edge is > 25 mm as per KDB 941225 D06 Hot Spot SAR.
- 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.
- 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.

## 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  $\pm 2^\circ\text{C}$  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 ( $\epsilon_r$ ) and conductivity ( $\sigma$ ) of typical tissue-equivalent media recipes are expected to be within  $\pm 5\%$  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  $\epsilon_r$  and  $\sigma$  may be relaxed to  $\pm 10\%$ . This is limited to frequencies  $\leq 3$  GHz.

#### Tissue Dielectric Parameters

FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

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

#### IEEE Std 1528-2013

Refer to Table 3 within the IEEE Std 1528-2013

**Dielectric Property Measurements Results:**

SAR Lab	Date	Band (MHz)	Tissue Type	Frequency (MHz)	Relative Permittivity ( $\epsilon_r$ )			Conductivity ( $\sigma$ )		
					Measured	Target	Delta (%)	Measured	Target	Delta (%)
5	8/21/2018	2450	Head	2450	39.51	39.20	0.79	1.79	1.80	-0.83
				2400	39.61	39.30	0.80	1.75	1.75	-0.15
				2480	39.45	39.16	0.73	1.81	1.83	-1.28
5	8/21/2018	2450	Body	2450	51.11	52.70	-3.02	2.02	1.95	3.59
				2400	51.22	52.77	-2.94	1.98	1.90	4.16
				2480	51.06	52.66	-3.04	2.05	1.99	2.90
5	8/27/2018	2450	Head	2450	38.38	39.20	-2.09	1.82	1.80	1.33
				2400	38.46	39.30	-2.13	1.79	1.75	2.02
				2480	38.30	39.16	-2.20	1.85	1.83	0.85
7	8/27/2018	1750/1900	Head	1750	38.32	40.08	-4.40	1.34	1.37	-1.82
				1710	38.48	40.15	-4.15	1.32	1.35	-1.81
				1900	38.04	40.00	-4.90	1.43	1.40	2.00
				1920	38.05	40.00	-4.88	1.44	1.40	2.79
7	8/27/2018	1750	Body	1750	51.96	53.44	-2.77	1.51	1.49	1.60
				1710	52.15	53.54	-2.60	1.48	1.46	1.54
				1755	51.95	53.43	-2.77	1.51	1.49	1.60
7	8/27/2018	1900	Body	1900	53.97	53.30	1.26	1.56	1.52	2.50
				1850	53.97	53.30	1.26	1.52	1.52	-0.13
				1920	53.97	53.30	1.26	1.57	1.52	3.55
7	8/29/2018	2600	Head	2600	38.45	39.01	-1.44	1.99	1.96	1.57
				2495	38.50	39.14	-1.64	1.89	1.85	1.97
				2690	38.19	38.90	-1.82	2.08	2.06	0.75
7	8/29/2018	2600	Body	2600	53.33	52.51	1.56	2.24	2.16	3.53
				2495	53.33	52.64	1.30	2.11	2.01	4.76
				2690	53.10	52.40	1.34	2.35	2.29	2.52
7	8/30/2018	5250	Head	5250	37.40	35.93	4.08	4.55	4.70	-3.34
				5150	37.60	36.05	4.31	4.46	4.60	-3.13
				5350	37.25	35.82	3.99	4.67	4.80	-2.88
7	8/30/2018	5600	Head	5600	36.81	35.53	3.59	4.93	5.06	-2.51
				5500	36.96	35.65	3.68	4.81	4.96	-3.06
				5725	36.63	35.39	3.50	5.09	5.19	-1.81
7	8/30/2018	5750	Head	5750	36.56	35.36	3.39	5.11	5.21	-2.05
				5700	36.61	35.42	3.36	5.08	5.16	-1.58
				5850	36.45	35.30	3.26	5.24	5.27	-0.59
8	8/27/2018	835/750	Head	695	41.92	42.24	-0.77	0.88	0.89	-0.48
				750	41.58	41.96	-0.91	0.90	0.89	1.32
				835	41.44	41.50	-0.14	0.93	0.90	3.62
				905	41.28	41.50	-0.53	0.96	0.97	-1.12
8	8/27/2018	835/750	Body	695	55.73	55.76	-0.05	0.93	0.96	-3.23
				750	55.41	55.55	-0.25	0.95	0.96	-1.44
				835	55.32	55.20	0.22	0.98	0.97	0.85
				905	55.22	55.00	0.40	1.01	1.05	-4.13
8	8/30/2018	5250	Body	5250	47.05	48.95	-3.89	5.37	5.35	0.22
				5150	47.26	49.09	-3.72	5.24	5.24	0.05
				5350	46.85	48.82	-4.03	5.51	5.47	0.72
8	8/30/2018	5600	Body	5600	46.40	48.48	-4.29	5.85	5.76	1.51
				5500	46.57	48.61	-4.20	5.70	5.64	0.93
				5725	46.17	48.31	-4.43	6.04	5.91	2.31
8	8/30/2018	5750	Body	5750	46.10	48.27	-4.50	6.08	5.94	2.36
				5700	46.19	48.34	-4.45	6.03	5.88	2.51
				5850	45.95	48.20	-4.67	6.23	6.00	3.80

## 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:  $2.0 \pm 0.2$  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  $\geq 15.0$  cm for SAR measurements  $\leq 3$  GHz and  $\geq 10.0$  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.

**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  $\pm 10\%$  of the manufacturer calibrated dipole SAR target. Refer to Appendix B for the SAR System Check Plots.

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 $\pm 10\%$	Zoom Scan to 100 mW	Normalize to 1 W	Target (Ref. Value)	Delta $\pm 10\%$	
5	8/21/2018	Head	D2450V2 SN:899	3/16/2019	5.120	51.20	51.75	-1.06	2.380	23.80	24.20	-1.65	
5	8/21/2018	Body	D2450V2 SN:899	3/16/2019	5.240	52.40	50.55	<b>3.66</b>	2.430	24.30	23.20	4.74	1,2
5	8/27/2018	Head	D2450V2 SN:899	3/16/2019	5.190	51.90	51.75	0.29	2.410	24.10	24.20	-0.41	
7	8/27/2018	Head	D1750V2 SN:1077	10/5/2018	3.780	37.80	36.26	4.25	1.990	19.90	19.34	2.90	
7	8/27/2018	Body	D1750V2 SN:1077	10/5/2018	3.960	39.60	37.34	<b>6.05</b>	2.100	21.00	19.98	5.11	3,4
7	8/27/2018	Head	D1900V2 SN:5d163	10/5/2018	4.190	41.90	38.77	<b>8.07</b>	2.160	21.60	20.10	7.46	5,6
7	8/27/2018	Body	D1900V2 SN:5d163	10/5/2018	4.310	43.10	42.99	0.26	2.230	22.30	21.97	1.50	
7	8/29/2018	Head	D2600V2 SN:1036	3/16/2019	5.710	57.10	54.54	<b>4.69</b>	2.550	25.50	24.56	3.83	7,8
7	8/29/2018	Body	D2600V2 SN:1036	3/16/2019	5.480	54.80	56.13	-2.37	2.420	24.20	25.04	-3.35	
7	8/30/2018	Head	D5GHzV2 SN:1003 (5.25 GHz)	3/13/2019	8.300	83.00	80.60	<b>2.98</b>	2.400	24.00	23.20	3.45	9,10
7	8/30/2018	Head	D5GHzV2 SN:1003 (5.60 GHz)	3/13/2019	8.740	87.40	84.50	<b>3.43</b>	2.480	24.80	24.00	3.33	11,12
7	8/30/2018	Head	D5GHzV2 SN:1003 (5.75 GHz)	3/13/2019	8.430	84.30	78.40	<b>7.53</b>	2.410	24.10	22.20	8.56	13,14
8	8/27/2018	Body	D750V3 SN:1071	11/21/2018	0.854	8.54	8.52	0.23	0.567	5.67	5.69	-0.35	
8	8/27/2018	Head	D750V3 SN:1071	11/21/2018	0.849	8.49	8.59	<b>-1.16</b>	0.554	5.54	5.73	-3.32	15,16
8	8/27/2018	Body	D835V2 SN:4d117	5/16/2019	0.996	9.96	10.31	<b>-3.39</b>	0.655	6.55	6.84	-4.24	17,18
8	8/27/2018	Head	D835V2 SN:4d117	5/16/2019	1.020	10.20	9.87	3.34	0.664	6.64	6.40	3.75	
8	8/30/2018	Body	D5GHzV2 SN:1003 (5.25 GHz)	3/13/2019	7.360	73.60	73.60	<b>0.00</b>	2.090	20.90	20.50	1.95	19,20
8	8/30/2018	Body	D5GHzV2 SN:1003 (5.60 GHz)	3/13/2019	7.960	79.60	77.70	<b>2.45</b>	2.230	22.30	21.70	2.76	21,22
8	8/30/2018	Body	D5GHzV2 SN:1003 (5.75 GHz)	3/13/2019	7.450	74.50	73.90	<b>0.81</b>	2.110	21.10	20.60	2.43	23,24

## 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.

#### 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	32.9	23.9	34.0	25.0
			190	836.6	33.0	24.0		
			251	848.8	33.0	24.0		
		2	128	824.2	30.2	24.2	32.0	26.0
			190	836.6	30.5	24.5		
			251	848.8	30.4	24.4		
		3	128	824.2	28.6	19.5	29.0	24.7
			190	836.6	28.8	19.8		
			251	848.8	28.7	19.6		
		4	128	824.2	27.2	21.1	28.0	25.0
			190	836.6	27.4	21.4		
			251	848.8	27.4	21.4		
EDGE (8PSK)	MCS5	1	128	824.2	26.6	17.5	27.0	18.0
			190	836.6	26.9	17.8		
			251	848.8	26.7	17.7		
		2	128	824.2	23.9	17.9	25.0	19.0
			190	836.6	24.2	18.2		
			251	848.8	24.2	18.2		
		3	128	824.2	22.5	13.4	24.0	19.7
			190	836.6	22.5	13.4		
			251	848.8	22.5	13.5		
		4	128	824.2	20.7	14.6	23.0	20.0
			190	836.6	20.7	14.7		
			251	848.8	20.7	14.7		

#### Notes:

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

- GPRS/EDGE (GMSK) mode with 2 time slots for Max power, based on the Tune-up Procedure.
- SAR is not required for EDGE (8PSK) mode because the maximum output power and tune-up limit is  $\leq 1/4$ dB higher than GPRS/EDGE (GMSK) or the adjusted SAR of the highest reported SAR of GPRS/EDGE (GMSK) is  $\leq 1.2$ W/kg.



**GSM1900 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	512	1850.2	29.4	20.3	31.0	22.0
			661	1880.0	29.7	20.7		
			810	1909.8	29.7	20.6		
		2	512	1850.2	26.8	20.8	28.5	22.5
			661	1880.0	27.2	21.1		
			810	1909.8	27.1	21.1		
		3	512	1850.2	25.7	16.7	26.5	22.2
			661	1880.0	26.2	17.2		
			810	1909.8	26.2	17.1		
		4	512	1850.2	24.6	18.6	25.0	22.0
			661	1880.0	25.0	18.9		
			810	1909.8	24.9	18.9		
EDGE (8PSK)	MCS5	1	512	1850.2	25.1	16.1	26.0	17.0
			661	1880.0	25.4	16.4		
			810	1909.8	25.4	16.3		
		2	512	1850.2	23.1	17.1	24.0	18.0
			661	1880.0	23.2	17.2		
			810	1909.8	23.3	17.3		
		3	512	1850.2	21.7	12.6	23.5	19.2
			661	1880.0	22.0	12.9		
			810	1909.8	21.8	12.8		
		4	512	1850.2	20.2	14.1	22.0	19.0
			661	1880.0	20.5	14.4		
			810	1909.8	20.3	14.2		

**Notes:**

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

- GPRS/EDGE (GMSK) mode with 2 time slots for Max power, based on the Tune-up Procedure.
- SAR is not required for EDGE (8PSK) mode because the maximum output power and tune-up limit is  $\leq 1/4$ dB higher than GPRS/EDGE (GMSK) or the adjusted SAR of the highest reported SAR of GPRS/EDGE (GMSK) is  $\leq 1.2$ W/kg.

## 9.2. W-CDMA

### 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 specification. The DUT supports power Class 3, which has a nominal maximum output power of 24 dBm (+1.7/-3.7).

Mode	Subtest	Rel99
WCDMA General Settings	Loopback Mode	Test Mode 2
	Rel99 RMC	12.2kbps RMC
	Power Control Algorithm	Algorithm2
	$\beta_c/\beta_d$	8/15

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

The following 4 Sub-tests were completed according to Release 9 procedures in section 5.2 of 3GPP TS34.121. A summary of these settings are illustrated below:

**Table C.10.2.4:  $\beta$  values for transmitter characteristics tests with HS-DPCCH**

	Mode	HSDPA	HSDPA	HSDPA	HSDPA
	Subtest	1	2	3	4
W-CDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set 1			
	Power Control Algorithm	Algorithm 2			
	$\beta_c$	2/15	11/15	15/15	15/15
	$\beta_d$	15/15	15/15	8/15	4/15
	Bd (SF)	64			
	$\beta_c/\beta_d$	2/15	11/15	15/8	15/4
	$\beta_{hs}$	4/15	24/15	30/15	30/15
MPR (dB)	0	0	0.5	0.5	
HSDPA Specific Settings	$D_{ACK}$	8			
	$D_{NAK}$	8			
	DCQI	8			
	Ack-Nack repetition factor	3			
	CQI Feedback (Table 5.2B.4)	4ms			
	CQI Repetition Factor (Table 5.2B.4)	2			
$A_{hs}=\beta_{hs}/\beta_c$	30/15				

**HSPA (HSDPA & HSUPA) Setup Procedures used to establish the test signals**

The following 5 Sub-tests were completed according to Release 9 procedures in table C,11.1.3 of 3GPP TS 34.121-1  
 A summary of these settings are illustrated below:

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

Mode	HSPA					
	Subtest	1	2	3	4	5
WCDMA General Settings	Loopback Mode	Test Mode 1				
	Rel99 RMC	12.2 kbps RMC				
	HSDPA FRC	H-Set 1				
	HSUPA Test	HSPA				
	Power Control Algorithm	Algorithm 2				Algorithm 1
	$\beta_c$	11/15	6/15	15/15	2/15	15/15
	$\beta_d$	15/15	15/15	9/15	15/15	0
	$\beta_{ec}$	209/225	12/15	30/15	2/15	5/15
	$\beta_c/\beta_d$	11/15	6/15	15/9	2/15	-
	$\beta_{hs}$	22/15	12/15	30/15	4/15	5/15
	$\beta_{ed}$	1309/225	94/75	47/15	56/75	47/15
CM (dB)	1	3	2	3	1	
MPR (dB)	0	2	1	2	0	
HSDPA Specific Settings	DACK	8				0
	DNAK	8				0
	DCQI	8				0
	Ack-Nack repetition factor	3				
	CQI Feedback (Table 5.2B.4)	4ms				
	CQI Repetition Factor (Table 5.2B.4)	2				
	$A_{hs} = \beta_{hs}/\beta_c$	30/15				
HSUPA Specific Settings	E-DPDCCH	6	8	8	5	0
	DHARQ	0	0	0	0	0
	AG Index	20	12	15	17	12
	ETFCI (from 34.121 Table C.11.1.3)	75	67	92	71	67
	Associated Max UL Data Rate kbps	242.1	174.9	482.8	205.8	308.9
	Reference E-TFCIs	5	5	2	5	1
	Reference E-TFCI	11	11	11	11	67
	Reference E-TFCI PO	4	4	4	4	18
	Reference E-TFCI	67	67	92	67	67
	Reference E-TFCI PO	18	18	18	18	18
	Reference E-TFCI	71	71	71	71	71
	Reference E-TFCI PO	23	23	23	23	23
	Reference E-TFCI	75	75	75	75	75
	Reference E-TFCI PO	26	26	26	26	26
	Reference E-TFCI	81	81	81	81	81
Reference E-TFCI PO	27	27	27	27	27	
Maximum Channelization Codes	2xSF2				SF4	

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

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

Downlink Physical Channels are set as per 3GPP TS34.121-1

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

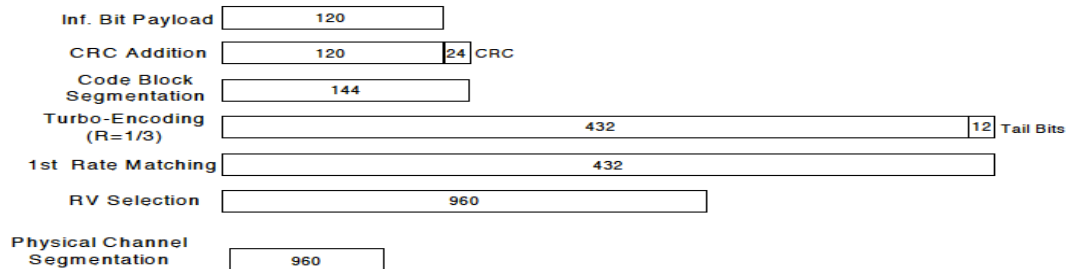
Parameter During Connection setup	Unit	Value
P-CPICH_Ec/Ior	dB	-10
P-CCPCH and SCH_Ec/Ior	dB	-12
PICH_Ec/Ior	dB	-15
HS-PDSCH	dB	off
HS-SCCH_1	dB	off
DPCH_Ec/Ior	dB	-5
OCNS_Ec/Ior	dB	-3.1

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

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

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

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



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

The following 4 Sub-tests for HSDPA were completed according to Release 9 procedures in section 5.2 of 3GPP TS34.121. A summary of subtest settings are illustrated below:

	Mode	HSDPA	HSDPA	HSDPA	HSDPA
	Subtest	1	2	3	4
WCDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set 1			
	Power Control Algorithm	Algorithm2			
	$\beta_c$	2/15	11/15	15/15	15/15
	$\beta_d$	15/15	15/15	8/15	4/15
	$\beta_d$ (SF)	64			
	$\beta_c/\beta_d$	2/15	12/15	15/8	15/4
$\beta_{hs}$	4/15	24/15	30/15	30/15	
MPR (dB)	0	0	0.5	0.5	
HSDPA Specific Settings	DACK	8			
	DNAK	8			
	DCQI	8			
	Ack-Nack Repetition factor	3			
	CQI Feedback	4ms			
	CQI Repetition Factor	2			
A <sub>hs</sub> = $\beta_{hs}/\beta_c$	30/15				

**HSPA+ Release 9**

Since 16QAM is not used for uplink, RF conducted power measurements are not required for HSPA+.

**W-CDMA Band II 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)	9262	1852.4	23.1	N/A	24.5
		9400	1880.0	23.3		
		9538	1907.6	23.4		
HSDPA	Subtest 1	9262	1852.4	22.2	0	23.0
		9400	1880.0	22.3		
		9538	1907.6	22.4		
	Subtest 2	9262	1852.4	22.2	0	23.0
		9400	1880.0	22.3		
		9538	1907.6	22.4		
	Subtest 3	9262	1852.4	21.3	0.5	22.5
		9400	1880.0	21.5		
		9538	1907.6	21.6		
	Subtest 4	9262	1852.4	21.2	0.5	22.5
		9400	1880.0	21.3		
		9538	1907.6	21.4		
HSUPA	Subtest 1	9262	1852.4	21.1	0	23.0
		9400	1880.0	21.3		
		9538	1907.6	21.4		
	Subtest 2	9262	1852.4	19.2	2	21.0
		9400	1880.0	19.5		
		9538	1907.6	19.6		
	Subtest 3	9262	1852.4	20.3	1	22.0
		9400	1880.0	20.5		
		9538	1907.6	20.5		
	Subtest 4	9262	1852.4	19.2	2	21.0
		9400	1880.0	19.5		
		9538	1907.6	19.6		
	Subtest 5	9262	1852.4	22.1	0	23.0
		9400	1880.0	22.3		
		9538	1907.6	22.4		
DC-HSDPA	Subtest 1	9262	1852.4	22.2	0	23.0
		9400	1880.0	22.3		
		9538	1907.6	22.4		
	Subtest 2	9262	1852.4	22.2	0	23.0
		9400	1880.0	22.3		
		9538	1907.6	22.4		
	Subtest 3	9262	1852.4	21.3	0.5	22.5
		9400	1880.0	21.5		
		9538	1907.6	21.6		
	Subtest 4	9262	1852.4	21.2	0.5	22.5
		9400	1880.0	21.3		
		9538	1907.6	21.4		

**Notes:**

Refer to W-CDMA MPR Attestation Letter for HSUPA MPR Explanation.

**W-CDMA Band IV 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)	1312	1712.4	23.1	N/A	24.5
		1413	1732.6	23.1		
		1513	1752.6	23.0		
HSDPA	Subtest 1	1312	1712.4	22.5	0	23.0
		1413	1732.6	22.5		
		1513	1752.6	22.4		
	Subtest 2	1312	1712.4	21.6	0	23.0
		1413	1732.6	21.6		
		1513	1752.6	21.5		
	Subtest 3	1312	1712.4	20.6	0.5	22.5
		1413	1732.6	20.5		
		1513	1752.6	20.5		
	Subtest 4	1312	1712.4	20.6	0.5	22.5
		1413	1732.6	20.5		
		1513	1752.6	20.5		
HSUPA	Subtest 1	1312	1712.4	19.6	2	21.0
		1413	1732.6	19.7		
		1513	1752.6	19.6		
	Subtest 2	1312	1712.4	17.6	4	19.0
		1413	1732.6	17.7		
		1513	1752.6	17.5		
	Subtest 3	1312	1712.4	20.6	1	22.0
		1413	1732.6	20.6		
		1513	1752.6	20.5		
	Subtest 4	1312	1712.4	17.7	4	19.0
		1413	1732.6	17.7		
		1513	1752.6	17.6		
	Subtest 5	1312	1712.4	22.5	0	23.0
		1413	1732.6	22.6		
		1513	1752.6	22.4		
DC-HSDPA	Subtest 1	1312	1712.4	22.5	0	23.0
		1413	1732.6	22.5		
		1513	1752.6	22.4		
	Subtest 2	1312	1712.4	21.6	0	23.0
		1413	1732.6	21.6		
		1513	1752.6	21.5		
	Subtest 3	1312	1712.4	20.6	0.5	22.5
		1413	1732.6	20.5		
		1513	1752.6	20.5		
	Subtest 4	1312	1712.4	20.6	0.5	22.5
		1413	1732.6	20.5		
		1513	1752.6	20.5		

**Notes:**

Refer to W-CDMA MPR Attestation Letter for HSUPA MPR Explanation.

**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	24.0	N/A	25.0
		4183	836.6	24.2		
		4233	846.6	24.2		
HSDPA	Subtest 1	4132	826.4	22.9	0	23.5
		4183	836.6	23.1		
		4233	846.6	23.1		
	Subtest 2	4132	826.4	22.0	0	23.5
		4183	836.6	22.3		
		4233	846.6	22.3		
	Subtest 3	4132	826.4	20.9	0.5	23.0
		4183	836.6	21.2		
		4233	846.6	21.1		
	Subtest 4	4132	826.4	20.9	0.5	23.0
		4183	836.6	21.2		
		4233	846.6	21.1		
HSUPA	Subtest 1	4132	826.4	20.1	2	21.5
		4183	836.6	20.2		
		4233	846.6	20.2		
	Subtest 2	4132	826.4	18.1	4	19.5
		4183	836.6	18.1		
		4233	846.6	18.3		
	Subtest 3	4132	826.4	21.0	1	22.5
		4183	836.6	21.3		
		4233	846.6	21.2		
	Subtest 4	4132	826.4	18.1	4	19.5
		4183	836.6	18.2		
		4233	846.6	18.2		
	Subtest 5	4132	826.4	23.0	0	23.5
		4183	836.6	23.2		
		4233	846.6	23.2		
DC-HSDPA	Subtest 1	4132	826.4	22.9	0	23.5
		4183	836.6	23.1		
		4233	846.6	23.1		
	Subtest 2	4132	826.4	22.0	0	23.5
		4183	836.6	22.3		
		4233	846.6	22.3		
	Subtest 3	4132	826.4	20.9	0.5	23.0
		4183	836.6	21.2		
		4233	846.6	21.1		
	Subtest 4	4132	826.4	20.9	0.5	23.0
		4183	836.6	21.2		
		4233	846.6	21.1		

**Notes:**

Refer to W-CDMA MPR Attestation Letter for HSUPA MPR Explanation.

### 9.3. 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 <sub>RB</sub> )						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
NS_03	6.6.2.2.1	2, 4, 10, 23, 25, 35, 36, 66, 70	3	>5	$\leq 1$
			5	>6	$\leq 1$
			10	>6	$\leq 1$
			15	>8	$\leq 1$
NS_04	6.6.2.2.2, 6.6.3.3.19	41	5, 10, 15, 20	Table 6.2.4-4, Table 6.2.4-4a	
				20	>10
NS_05	6.6.3.3.1	1	10, 15, 20	$\geq 50$ (NOTE 1)	$\leq 1$ (NOTE 1)
			15, 20	Table 6.2.4-18 (NOTE 2)	
		65 (NOTE 3)	10, 15, 20	$\geq 50$	$\leq 1$ (NOTE 1)
NS_06	6.6.2.2.3	12, 13, 14, 17	1.4, 3, 5, 10	Table 5.6-1	N/A
NS_07	6.6.2.2.3	13	10	Table 6.2.4-2	
NS_08	6.6.3.3.2			10, 15	> 44
NS_09	6.6.3.3.3	19	10, 15	> 40	$\leq 1$
				> 55	$\leq 2$
NS_10	6.6.3.3.4	21	10, 15	Table 6.2.4-3	
NS_11	6.6.2.2.1	23	1.4, 3, 5, 10, 15, 20	Table 6.2.4-5	
NS_12	6.6.3.3.13			1.4, 3, 5, 10, 15	Table 6.2.4-6
NS_13	6.6.3.3.5	26	5	Table 6.2.4-7	
NS_14	6.6.3.3.6	26	10, 15	Table 6.2.4-8	
NS_15	6.6.3.3.7	26	1.4, 3, 5, 10, 15	Table 6.2.4-9 Table 6.2.4-10	
NS_16	6.6.3.3.8	26	3, 5, 10	Table 6.2.4-11, Table 6.2.4-12, Table 6.2.4-13	
NS_17	6.6.3.3.9	27	5, 10	Table 5.6-1	N/A
NS_18	6.6.3.3.10	28	5	$\geq 2$	$\leq 1$
			10, 15, 20	$\geq 1$	$\leq 4$
NS_19	6.6.3.3.11	44	10, 15, 20	Table 6.2.4-14	
NS_20	6.2.2	23	5, 10, 15, 20	Table 6.2.4-15	
	6.6.2.2.1			Table 6.2.4-16	
NS_21	6.6.3.3.14	30	5, 10	Table 6.2.4-16	
NS_22	6.6.2.2.1	30	5, 10	Table 6.2.4-16	
NS_22	6.6.3.3.15	42, 43	5, 10, 15, 20	Table 6.2.4-17	
NS_23	6.6.3.3.16	42, 43	5, 10, 15, 20	N/A	
NS_24	6.6.3.3.17	65 (NOTE 4)	5, 10, 15, 20	Table 6.2.4-19	
NS_25	6.6.3.3.18	65 (NOTE 4)	5, 10, 15, 20	Table 6.2.4-20	
NS_26	6.6.3.3.19	68	10, 15	Table 6.2.4-21	
NS_27	6.6.2.2.5	48	5, 10, 15, 20	Table 6.2.4-22	
	6.6.3.3.23			Table 6.2.4-22	
NS_28	6.2.2A, 6.6.3.3.24	46 (NOTE 5)	20	Table 6.2.4-23	
NS_29	6.2.2A, 6.6.2.3.1a, 6.6.3.3.25	46 (NOTE 5)	20	Table 6.2.4-24	
NS_30	6.2.2A, 6.6.3.3.26	46 (NOTE 5)	20	Table 6.2.4-25	
NS_31	6.2.2A, 6.6.3.3.27	46 (NOTE 5)	20	Table 6.2.4-26	
NS_32	-	-	-	-	-

NOTE 1: Applicable when the lower edge of the assigned E-UTRA UL channel bandwidth frequency is larger than or equal to the upper edge of PHS band (1915.7 MHz) + 4 MHz + the channel BW assigned, where channel BW is as defined in subclause 5.6. A-MPR for

**LTE Band 2 Measured Results**

BW (MHz)	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)				
				18700	18900	19100	MPR	Tune-up Limit
				1860 MHz	1880 MHz	1900 MHz		
20 MHz	QPSK	1	0	22.9	23.0	22.9	0	24.5
		1	49	22.8	22.9	22.8	0	24.5
		1	99	22.8	22.9	22.8	0	24.5
		50	0	21.8	22.0	22.0	1	23.5
		50	24	21.8	22.0	22.0	1	23.5
		50	50	21.8	21.9	21.9	1	23.5
	16QAM	100	0	21.8	22.0	22.0	1	23.5
		1	0	21.6	21.8	22.0	1	23.5
		1	49	21.6	21.7	21.9	1	23.5
		1	99	21.6	21.6	21.9	1	23.5
		50	0	20.9	21.0	21.0	2	22.5
		50	24	20.9	21.0	21.0	2	22.5
15 MHz	QPSK	50	50	20.8	21.0	20.9	2	22.5
		100	0	20.8	21.0	21.0	2	22.5
		1	0	22.8	23.0	23.1	0	24.5
		1	37	22.8	23.0	22.9	0	24.5
		1	74	22.7	22.9	22.9	0	24.5
		36	0	21.9	22.0	22.1	1	23.5
	16QAM	36	20	21.8	22.0	22.0	1	23.5
		36	39	21.8	22.0	22.0	1	23.5
		75	0	21.8	22.0	22.0	1	23.5
		1	0	21.8	21.9	22.1	1	23.5
		1	37	21.7	21.9	22.1	1	23.5
		1	74	21.7	21.8	22.0	1	23.5
10 MHz	QPSK	36	0	20.9	21.1	21.0	2	22.5
		36	20	20.9	21.0	21.0	2	22.5
		36	39	20.9	21.0	21.0	2	22.5
		75	0	20.9	21.0	21.1	2	22.5
		1	0	22.7	23.0	23.0	0	24.5
		1	25	22.7	23.0	23.0	0	24.5
	16QAM	1	49	22.7	23.0	22.9	0	24.5
		25	0	21.8	22.0	21.9	1	23.5
		25	12	21.7	22.0	21.9	1	23.5
		25	25	21.7	22.0	21.9	1	23.5
		50	0	21.7	22.0	21.9	1	23.5
		1	0	21.8	22.0	21.6	1	23.5
16QAM	1	25	21.8	22.0	21.6	1	23.5	
	1	49	21.8	22.0	21.6	1	23.5	
	25	0	20.8	21.0	21.0	2	22.5	
	25	12	20.8	21.0	20.9	2	22.5	
	25	25	20.7	21.0	20.9	2	22.5	
	50	0	20.7	21.1	21.0	2	22.5	

**LTE Band 2 Measured Results (continued)**

BW (MHz)	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)				
				18625	18900	19175	MPR	Tune-up Limit
				1852.5 MHz	1880 MHz	1907.5 MHz		
5 MHz	QPSK	1	0	22.7	23.0	22.9	0	24.5
		1	12	22.7	23.0	22.9	0	24.5
		1	24	22.7	23.0	22.9	0	24.5
		12	0	21.8	22.0	22.0	1	23.5
		12	7	21.7	22.0	21.9	1	23.5
		12	13	21.7	22.0	21.9	1	23.5
		25	0	21.7	22.0	22.0	1	23.5
	16QAM	1	0	21.7	22.1	21.8	1	23.5
		1	12	21.7	22.0	21.8	1	23.5
		1	24	21.7	22.1	21.8	1	23.5
		12	0	20.8	21.0	21.0	2	22.5
		12	7	20.8	21.0	21.0	2	22.5
		12	13	20.8	21.0	21.0	2	22.5
		25	0	20.8	21.0	21.0	2	22.5
BW (MHz)	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)				
				18615	18900	19185	MPR	Tune-up Limit
				1851.5 MHz	1880 MHz	1908.5 MHz		
3 MHz	QPSK	1	0	22.8	23.1	23.1	0	24.5
		1	8	22.8	23.0	23.1	0	24.5
		1	14	22.8	23.0	23.0	0	24.5
		8	0	21.8	22.0	22.0	1	23.5
		8	4	21.8	22.0	22.0	1	23.5
		8	7	21.8	22.0	22.0	1	23.5
		15	0	21.8	22.1	22.0	1	23.5
	16QAM	1	0	21.6	21.9	21.9	1	23.5
		1	8	21.6	21.9	21.9	1	23.5
		1	14	21.6	21.9	21.8	1	23.5
		8	0	20.8	21.0	21.0	2	22.5
		8	4	20.8	21.0	21.0	2	22.5
		8	7	20.8	21.0	21.0	2	22.5
		15	0	20.8	21.0	21.0	2	22.5
BW (MHz)	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)				
				18607	18900	19193	MPR	Tune-up Limit
				1850.7 MHz	1880 MHz	1909.3 MHz		
1.4 MHz	QPSK	1	0	22.8	23.2	23.2	0	24.5
		1	3	22.8	23.1	23.1	0	24.5
		1	5	22.8	23.2	23.2	0	24.5
		3	0	22.8	23.1	23.1	0	24.5
		3	1	22.8	23.1	23.1	0	24.5
		3	3	22.9	23.1	23.1	0	24.5
		6	0	21.8	22.1	22.1	1	23.5
	16QAM	1	0	21.6	21.8	21.7	1	23.5
		1	3	21.7	21.7	21.7	1	23.5
		1	5	21.6	21.8	21.8	1	23.5
		3	0	21.8	22.0	22.1	1	23.5
		3	1	21.8	22.1	22.1	1	23.5
		3	3	21.8	22.0	22.1	1	23.5
		6	0	20.8	21.1	21.1	2	22.5

**LTE Band 4 Measured Results**

LTE Band 4 (Frequency range: 1710-1755 MHz) is covered by LTE Band 66 (Frequency range: 1710-1780 MHz) due to similar frequency range, same maximum tune-up limit and same channel bandwidth.

**LTE Band 5 Measured Results**

BW (MHz)	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)				
				20450	20525	20600	MPR	Tune-up Limit
				829 MHz	836.5 MHz	844 MHz		
10 MHz	QPSK	1	0		23.1		0	25
		1	25		23.1		0	25
		1	49		23.1		0	25
		25	0		22.0		1	24
		25	12		22.0		1	24
		25	25		22.0		1	24
		50	0		22.1		1	24
	16QAM	1	0		22.0		1	24
		1	25		21.9		1	24
		1	49		22.0		1	24
		25	0		21.0		2	23
		25	12		21.0		2	23
		25	25		21.0		2	23
		50	0		21.0		2	23
BW (MHz)	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)				
				20425	20525	20625	MPR	Tune-up Limit
				826.5 MHz	836.5 MHz	846.5 MHz		
5 MHz	QPSK	1	0	23.0	23.1	23.1	0	25
		1	12	22.9	23.1	23.0	0	25
		1	24	23.0	23.1	23.0	0	25
		12	0	22.0	22.0	22.1	1	24
		12	7	21.9	22.0	22.1	1	24
		12	13	21.9	22.0	22.0	1	24
		25	0	21.9	22.1	22.1	1	24
	16QAM	1	0	21.8	21.9	21.9	1	24
		1	12	21.7	21.8	21.8	1	24
		1	24	21.7	21.9	21.8	1	24
		12	0	20.8	20.9	21.0	2	23
		12	7	20.8	20.9	20.9	2	23
		12	13	20.8	20.9	20.9	2	23
		25	0	20.8	20.9	20.9	2	23
BW (MHz)	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)				
				20415	20525	20635	MPR	Tune-up Limit
				825.5 MHz	836.5 MHz	847.5 MHz		
3 MHz	QPSK	1	0	23.0	23.2	23.3	0	25
		1	8	23.0	23.2	23.2	0	25
		1	14	23.0	23.2	23.2	0	25
		8	0	21.9	22.0	22.1	1	24
		8	4	21.9	22.0	22.1	1	24
		8	7	21.9	22.0	22.0	1	24
		15	0	22.0	22.1	22.1	1	24
	16QAM	1	0	21.9	22.1	22.0	1	24
		1	8	21.9	21.9	22.1	1	24
		1	14	22.0	22.0	22.0	1	24
		8	0	20.8	20.9	20.9	2	23
		8	4	20.8	20.9	20.9	2	23
		8	7	20.7	20.9	20.9	2	23
		15	0	20.8	20.9	20.9	2	23

**Note(s):**  
 10 MHz Bandwidths does not support at least three non-overlapping channels in certain channel bandwidths. When a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing per KDB 941225 D05 SAR for LTE Devices.

**LTE Band 5 Measured Results (continued)**

BW (MHz)	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)				
				20407	20525	20643	MPR	Tune-up Limit
				824.7 MHz	836.5 MHz	848.3 MHz		
1.4 MHz	QPSK	1	0	23.0	23.2	23.2	0	25
		1	3	23.1	23.2	23.2	0	25
		1	5	23.1	23.1	23.2	0	25
		3	0	23.0	23.1	23.2	0	25
		3	1	23.0	23.1	23.2	0	25
		3	3	23.0	23.1	23.1	0	25
	6	0	21.9	22.0	22.0	1	24	
	16QAM	1	0	21.5	21.8	21.8	1	24
		1	3	21.5	21.8	21.8	1	24
		1	5	21.5	21.9	21.8	1	24
		3	0	22.0	22.1	22.1	1	24
		3	1	22.0	21.9	22.1	1	24
		3	3	22.0	22.0	22.1	1	24
	6	0	20.8	20.8	21.0	2	23	

**LTE Band 12 Measured Results**

BW (MHz)	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)				
				23060	23095	23130	MPR	Tune-up Limit
				704 MHz	707.5 MHz	711 MHz		
10 MHz	QPSK	1	0		23.1		0	25
		1	25		23.0		0	25
		1	49		23.0		0	25
		25	0		22.1		1	24
		25	12		22.0		1	24
		25	25		22.0		1	24
		50	0		22.0		1	24
	16QAM	1	0		22.0		1	24
		1	25		21.9		1	24
		1	49		21.9		1	24
		25	0		21.0		2	23
		25	12		21.0		2	23
		25	25		20.9		2	23
		50	0		21.0		2	23
BW (MHz)	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)				
				23035	23095	23155	MPR	Tune-up Limit
				701.5 MHz	707.5 MHz	713.5 MHz		
5 MHz	QPSK	1	0	23.1	23.0	23.0	0	25
		1	12	23.0	23.0	22.9	0	25
		1	24	23.0	23.0	23.0	0	25
		12	0	22.1	22.0	22.0	1	24
		12	7	22.0	22.0	22.0	1	24
		12	13	22.0	22.0	22.1	1	24
		25	0	22.0	22.0	22.0	1	24
	16QAM	1	0	22.0	22.0	21.9	1	24
		1	12	21.8	21.9	21.9	1	24
		1	24	21.8	22.0	21.9	1	24
		12	0	20.9	20.9	20.9	2	23
		12	7	20.8	20.9	20.9	2	23
		12	13	20.8	20.9	20.9	2	23
		25	0	20.9	20.9	20.9	2	23
BW (MHz)	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)				
				23025	23095	23165	MPR	Tune-up Limit
				700.5 MHz	707.5 MHz	714.5 MHz		
3 MHz	QPSK	1	0	23.0	23.0	23.0	0	25
		1	8	22.9	23.0	23.0	0	25
		1	14	22.9	23.0	23.1	0	25
		8	0	22.0	22.0	22.0	1	24
		8	4	22.0	22.0	22.0	1	24
		8	7	22.0	22.0	22.0	1	24
		15	0	22.0	22.0	22.1	1	24
	16QAM	1	0	21.8	22.0	21.8	1	24
		1	8	21.9	22.0	21.8	1	24
		1	14	21.9	22.0	21.8	1	24
		8	0	20.8	20.9	20.9	2	23
		8	4	20.8	20.9	20.9	2	23
		8	7	20.8	21.0	20.9	2	23
		15	0	20.8	21.0	20.9	2	23

**Note(s):**

10 MHz Bandwidths does not support at least three non-overlapping channels in certain channel bandwidths. When a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing per KDB 941225 D05 SAR for LTE Devices.

**LTE Band 12 Measured Results (continued)**

BW (MHz)	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)				
				23017	23095	23173	MPR	Tune-up Limit
				699.7 MHz	707.5 MHz	715.3 MHz		
1.4 MHz	QPSK	1	0	23.1	23.0	23.0	0	25
		1	3	23.1	23.0	22.9	0	25
		1	5	23.1	23.0	23.0	0	25
		3	0	23.1	23.0	23.0	0	25
		3	1	23.1	23.0	23.0	0	25
		3	3	23.1	23.0	23.0	0	25
	16QAM	1	0	21.8	21.7	21.9	1	24
		1	3	21.7	21.6	21.9	1	24
		1	5	21.8	21.7	21.9	1	24
		3	0	22.0	22.0	22.0	1	24
		3	1	22.0	22.0	21.9	1	24
		3	3	22.0	21.9	21.9	1	24
		6	0	21.0	20.9	20.7	2	23

**LTE Band 13 Measured Results**

BW (MHz)	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)				
				23230	MPR	Tune-up Limit		
				782 MHz				
10 MHz	QPSK	1	0	22.9	0	24.5		
		1	25	22.8	0	24.5		
		1	49	22.8	0	24.5		
		25	0	21.8	1	23.5		
		25	12	21.8	1	23.5		
		25	25	21.8	1	23.5		
	16QAM	50	0	21.8	1	23.5		
		1	0	21.8	1	23.5		
		1	25	21.7	1	23.5		
		1	49	21.8	1	23.5		
		25	0	20.8	2	22.5		
		25	12	20.7	2	22.5		
		25	25	20.7	2	22.5		
		50	0	20.8	2	22.5		
5 MHz	Mode	RB Allocation	RB offset	23230	782 MHz	MPR	Tune-up Limit	
5 MHz	QPSK	1	0	22.7	0	24.5		
		1	12	22.7	0	24.5		
		1	24	22.7	0	24.5		
		12	0	21.8	1	23.5		
		12	7	21.8	1	23.5		
		12	13	21.8	1	23.5		
	16QAM	25	0	21.8	1	23.5		
		1	0	21.7	1	23.5		
		1	12	21.7	1	23.5		
		1	24	21.7	1	23.5		
		12	0	20.7	2	22.5		
		12	7	20.7	2	22.5		
		12	13	20.7	2	22.5		
		25	0	20.7	2	22.5		

**Note(s):**

10/5 MHz Bandwidths does not support at least three non-overlapping channels in certain channel bandwidths. When a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing per KDB 941225 D05 SAR for LTE Devices

**LTE Band 17 Measured Results**

LTE Band 17 (Frequency range: 704-716 MHz) is covered by LTE Band 12 (Frequency range: 699-716 MHz) due to similar frequency range, same maximum tune-up limit and same channel bandwidth.



**LTE Band 41 Measured Results**

BW (MHz)	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)						
				39750	40185	40620	41055	41490	MPR	Tune-up Limit
				2506 MHz	2549.5 MHz	2593 MHz	2636.5 MHz	2680 MHz		
20 MHz	QPSK	1	0	22.6	22.8	23.1	23.6	23.7	0	24.5
		1	49	22.7	22.8	23.1	23.6	23.8	0	24.5
		1	99	22.7	22.8	23.1	23.6	23.8	0	24.5
		50	0	21.6	21.9	22.1	22.5	22.8	1	23.5
		50	24	21.6	21.9	22.2	22.5	22.8	1	23.5
		50	50	21.6	21.9	22.2	22.5	22.8	1	23.5
	16QAM	1	0	21.3	21.7	21.7	22.6	22.6	1	23.5
		1	49	21.3	21.8	22.0	22.4	22.7	1	23.5
		1	99	21.5	21.6	21.7	22.4	22.7	1	23.5
		50	0	20.6	20.9	21.2	21.4	21.8	2	22.5
		50	24	20.6	20.9	21.2	21.5	21.8	2	22.5
		50	50	20.6	20.9	21.2	21.5	21.9	2	22.5
		100	0	20.6	20.9	21.2	21.5	21.8	2	22.5
		100	0	20.6	20.9	21.2	21.5	21.8	2	22.5
15 MHz	QPSK	1	0	22.5	22.8	23.2	23.4	23.8	0	24.5
		1	37	22.5	22.8	23.2	23.4	23.8	0	24.5
		1	74	22.5	22.9	23.2	23.4	23.8	0	24.5
		36	0	21.6	21.9	22.2	22.5	22.8	1	23.5
		36	20	21.6	21.9	22.2	22.5	22.8	1	23.5
		36	39	21.7	21.9	22.2	22.5	22.8	1	23.5
		75	0	21.7	21.9	22.2	22.5	22.8	1	23.5
	16QAM	1	0	21.1	21.8	21.9	22.2	22.6	1	23.5
		1	37	21.2	22.1	21.9	22.2	22.7	1	23.5
		1	74	21.3	22.1	21.9	22.3	23.2	1	23.5
		36	0	20.7	20.9	21.3	21.5	21.8	2	22.5
		36	20	20.6	21.0	21.2	21.5	21.8	2	22.5
		36	39	20.7	21.0	21.2	21.5	21.9	2	22.5
		75	0	20.7	20.9	21.2	21.5	21.8	2	22.5
10 MHz	QPSK	1	0	22.5	22.8	23.2	23.4	23.7	0	24.5
		1	25	22.6	22.8	23.2	23.4	23.7	0	24.5
		1	49	22.6	22.8	23.2	23.4	23.8	0	24.5
		25	0	21.6	21.9	22.2	22.4	22.8	1	23.5
		25	12	21.6	21.9	22.2	22.4	22.8	1	23.5
		25	25	21.6	21.9	22.2	22.4	22.8	1	23.5
		50	0	21.6	21.9	22.2	22.4	22.8	1	23.5
	16QAM	1	0	21.3	21.8	21.7	22.3	22.8	1	23.5
		1	25	21.3	21.7	21.7	22.3	22.8	1	23.5
		1	49	21.3	21.7	21.7	22.3	22.8	1	23.5
		25	0	20.7	20.9	21.1	21.4	21.8	2	22.5
		25	12	20.7	20.9	21.2	21.5	21.8	2	22.5
		25	25	20.7	20.9	21.2	21.5	21.8	2	22.5
		50	0	20.7	20.9	21.2	21.5	21.8	2	22.5
5 MHz	QPSK	1	0	22.6	22.9	23.1	23.5	23.8	0	24.5
		1	12	22.6	22.9	23.1	23.5	23.8	0	24.5
		1	24	22.6	22.9	23.2	23.5	23.8	0	24.5
		12	0	21.6	21.9	22.2	22.4	22.7	1	23.5
		12	7	21.6	21.9	22.2	22.4	22.7	1	23.5
		12	13	21.7	21.8	22.2	22.4	22.7	1	23.5
		25	0	21.6	21.8	22.2	22.5	22.7	1	23.5
	16QAM	1	0	21.4	21.6	21.7	22.3	22.6	1	23.5
		1	12	21.4	21.6	21.7	22.2	22.6	1	23.5
		1	24	21.4	21.6	21.7	22.3	22.6	1	23.5
		12	0	20.7	20.8	21.1	21.5	21.7	2	22.5
		12	7	20.7	20.8	21.1	21.5	21.7	2	22.5
		12	13	20.7	20.8	21.1	21.5	21.7	2	22.5
		25	0	20.7	20.9	21.2	21.5	21.8	2	22.5

**LTE Band 66 Measured Results**

BW (MHz)	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)				
				132072	132322	132572	MPR	Tune-up Limit
				1720 MHz	1745 MHz	1770 MHz		
20 MHz	QPSK	1	0	22.5	22.7	22.5	0	24.5
		1	49	22.5	22.6	22.4	0	24.5
		1	99	22.4	22.5	22.3	0	24.5
		50	0	21.6	21.7	21.5	1	23.5
		50	24	21.6	21.7	21.5	1	23.5
		50	50	21.5	21.6	21.4	1	23.5
	16QAM	100	0	21.6	21.7	21.5	1	23.5
		1	0	21.5	21.4	21.3	1	23.5
		1	49	21.4	21.3	21.2	1	23.5
		1	99	21.3	21.2	21.2	1	23.5
		50	0	20.6	20.7	20.5	2	22.5
		50	24	20.6	20.7	20.5	2	22.5
15 MHz	QPSK	50	50	20.6	20.6	20.4	2	22.5
		100	0	20.6	20.7	20.5	2	22.5
		1	0	22.5	22.7	22.5	0	24.5
		1	37	22.5	22.6	22.4	0	24.5
		1	74	22.4	22.5	22.4	0	24.5
		36	0	21.6	21.7	21.6	1	23.5
	16QAM	36	20	21.6	21.7	21.5	1	23.5
		36	39	21.5	21.6	21.5	1	23.5
		75	0	21.6	21.7	21.5	1	23.5
		1	0	21.6	21.6	21.4	1	23.5
		1	37	21.5	21.5	21.3	1	23.5
		1	74	21.5	21.5	21.2	1	23.5
10 MHz	QPSK	36	0	20.6	20.7	20.6	2	22.5
		36	20	20.5	20.7	20.5	2	22.5
		36	39	20.5	20.7	20.5	2	22.5
		75	0	20.6	20.7	20.6	2	22.5
		1	0	22.5	22.7	22.5	0	24.5
		1	25	22.5	22.6	22.4	0	24.5
	16QAM	1	49	22.5	22.6	22.4	0	24.5
		25	0	21.6	21.7	21.5	1	23.5
		25	12	21.5	21.7	21.5	1	23.5
		25	25	21.5	21.6	21.5	1	23.5
		50	0	21.6	21.7	21.5	1	23.5
		1	0	21.5	21.7	21.5	1	23.5
10 MHz	16QAM	1	25	21.4	21.6	21.5	1	23.5
		1	49	21.4	21.6	21.5	1	23.5
		25	0	20.5	20.7	20.5	2	22.5
		25	12	20.5	20.7	20.5	2	22.5
		25	25	20.5	20.7	20.5	2	22.5
		50	0	20.6	20.7	20.5	2	22.5

**LTE Band 66 Measured Results (continued)**

BW (MHz)	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)				
				131997	132322	132647	MPR	Tune-up Limit
				1712.5 MHz	1745 MHz	1777.5 MHz		
5 MHz	QPSK	1	0	22.4	22.6	22.5	0	24.5
		1	12	22.3	22.5	22.4	0	24.5
		1	24	22.4	22.6	22.5	0	24.5
		12	0	21.5	21.7	21.5	1	23.5
		12	7	21.5	21.6	21.5	1	23.5
		12	13	21.5	21.6	21.5	1	23.5
		25	0	21.5	21.6	21.5	1	23.5
	16QAM	1	0	21.4	21.4	21.4	1	23.5
		1	12	21.3	21.4	21.4	1	23.5
		1	24	21.3	21.4	21.4	1	23.5
		12	0	20.6	20.6	20.6	2	22.5
		12	7	20.5	20.6	20.5	2	22.5
		12	13	20.5	20.6	20.5	2	22.5
		25	0	20.6	20.6	20.5	2	22.5
BW (MHz)	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)				
				131987	132322	132657	MPR	Tune-up Limit
				1711.5 MHz	1745 MHz	1778.5 MHz		
3 MHz	QPSK	1	0	22.5	22.7	22.5	0	24.5
		1	8	22.5	22.6	22.5	0	24.5
		1	14	22.5	22.7	22.5	0	24.5
		8	0	21.5	21.6	21.5	1	23.5
		8	4	21.5	21.6	21.5	1	23.5
		8	7	21.5	21.6	21.5	1	23.5
		15	0	21.5	21.7	21.5	1	23.5
	16QAM	1	0	21.3	21.6	21.6	1	23.5
		1	8	21.3	21.6	21.5	1	23.5
		1	14	21.3	21.6	21.6	1	23.5
		8	0	20.5	20.7	20.5	2	22.5
		8	4	20.5	20.7	20.5	2	22.5
		8	7	20.5	20.7	20.5	2	22.5
		15	0	20.5	20.7	20.5	2	22.5
BW (MHz)	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)				
				131979	132322	132665	MPR	Tune-up Limit
				1710.7 MHz	1745 MHz	1779.3 MHz		
1.4 MHz	QPSK	1	0	22.6	22.7	22.6	0	24.5
		1	3	22.5	22.7	22.5	0	24.5
		1	5	22.5	22.7	22.6	0	24.5
		3	0	22.5	22.6	22.5	0	24.5
		3	1	22.5	22.6	22.5	0	24.5
		3	3	22.5	22.6	22.5	0	24.5
		6	0	21.5	21.7	21.5	1	23.5
	16QAM	1	0	21.3	21.5	21.3	1	23.5
		1	3	21.3	21.4	21.3	1	23.5
		1	5	21.4	21.5	21.3	1	23.5
		3	0	21.5	21.6	21.4	1	23.5
		3	1	21.5	21.6	21.4	1	23.5
		3	3	21.5	21.6	21.4	1	23.5
		6	0	20.5	20.7	20.5	2	22.5

## 9.4. 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 WPKD 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

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

Where  $M_A$  is defined as follows

$$M_A = \begin{array}{ll} 8.2 & ; 0 \leq A < 0.025 \\ 9.2 - 40A & ; 0.025 \leq A < 0.05 \\ 8 - 16A & ; 0.05 \leq A < 0.25 \\ 4.83 - 3.33A & ; 0.25 \leq A \leq 0.4 \\ 3.83 - 0.83A & ; 0.4 \leq A \leq 1 \end{array}$$

and  $M_{IM5}$  is defined as follows

$$M_{IM5} = \begin{array}{ll} 4.5 & ; \Delta_{IM5} < 1.5 * \text{BW}_{\text{Channel\_CA}} \\ 6.0 & ; 1.5 * \text{BW}_{\text{Channel\_CA}} \leq \Delta_{IM5} < \text{BW}_{\text{Channel\_CA}}/2 + \Delta f_{\text{ooB}} \\ M_A & ; \Delta_{IM5} \geq \text{BW}_{\text{Channel\_CA}}/2 + \Delta f_{\text{ooB}} \end{array}$$

Where

$$A = N_{\text{RB\_alloc}} / N_{\text{RB\_agg}}$$

$$\Delta_{IM5} = \max(|F_{\text{C\_agg}} - (3 * F_{\text{agg\_alloc\_low}} - 2 * F_{\text{agg\_alloc\_high}})|, |F_{\text{C\_agg}} - (3 * F_{\text{agg\_alloc\_high}} - 2 * F_{\text{agg\_alloc\_low}})|)$$

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

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 for those E-UTRA bands where maximum possible  $W_{\text{GAP}} \leq 42.2$  MHz as follows

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

Where  $M_N$  is defined as follows

$$M_N = \begin{array}{ll} -0.125N + 18.25 & ; 2 \leq N \leq 50 \\ -0.0333 N + 13.67 & ; 50 < N \leq 200 \end{array}$$

Where  $N = N_{\text{RB\_alloc}}$  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.

**LTE Carrier Aggregation Measured Results**

The following power measurements were performed with a single carrier uplink; CA for this particular project is only supported in the downlinks. The CA combinations supported by this device is one (1) Uplink and two (2) Downlinks.

Type	LTE CA combinations		PCC (UL)				SCC (DL)			LTE Rel 8 Tx. Power (dBm)	LTE Rel 10 Tx. Power (dBm)	Delta (dBm)		
	PCC	+	SCC	Mode	BW (MHz)	Channel	Freq. (MHz)	RB/Offset	BW (MHz)				Channel	Freq. (MHz)
Intra-Band Contiguous	2C		QPSK	20	18801	1870.1	1,0	20	999	1969.9	22.96	22.87	-0.09	
	41C		QPSK	20	39750	2506.0	1,0	20	39948	2525.8	22.65	22.56	-0.09	
Intra-Band Non-Contiguous	2A	+	2A	QPSK	20	18700	1860.0	1,0	20	1100	1980.0	22.81	22.75	-0.06
	4A	+	4A	QPSK	20	20050	1720.0	1,0	20	2300	2145.0	22.54	22.53	-0.01
	41A	+	41A	QPSK	20	39750	2506.0	1,0	20	41490	2680.0	22.65	22.54	-0.11
Inter-Band Non-Contiguous	2A	+	12A	QPSK	20	18700	1860.0	1,0	10	5095	737.5	22.81	22.77	-0.04
	4A	+	17A	QPSK	10	20000	1715.0	1,0	10	5790	740.0	22.61	22.57	-0.04

**Note:**

Per KDB 941225 D05A LTE Rel. 10 KDB Inquiry Sheet: SAR is excluded for Carrier Aggregation when measured power does not exceed LTE Release 8 by more than a 1/4 dBm

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

#### Wi-Fi 2.4GHz Measured Results

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	14.0	15.0	Yes	12.8	13.0	Yes	
			2	2417	18.6	19.0		12.3	13.0		
			6	2437	18.6	19.0		12.3	13.0		
			10	2457	18.5	19.0		12.3	13.0		
			11	2462	16.0	16.0		12.5	13.0		
OFDM 2.4 GHz	802.11g	6 Mbps	1	2412	Not Required	17.0	No	Not Required	13.0	No	
			6	2437							17.0
			11	2462							17.0
	802.11n (HT20)	6.5 Mbps	1	2412	Not Required	17.0	No	Not Required	13.0	No	
			6	2437							17.0
			11	2462							15.0

**Note(s):**

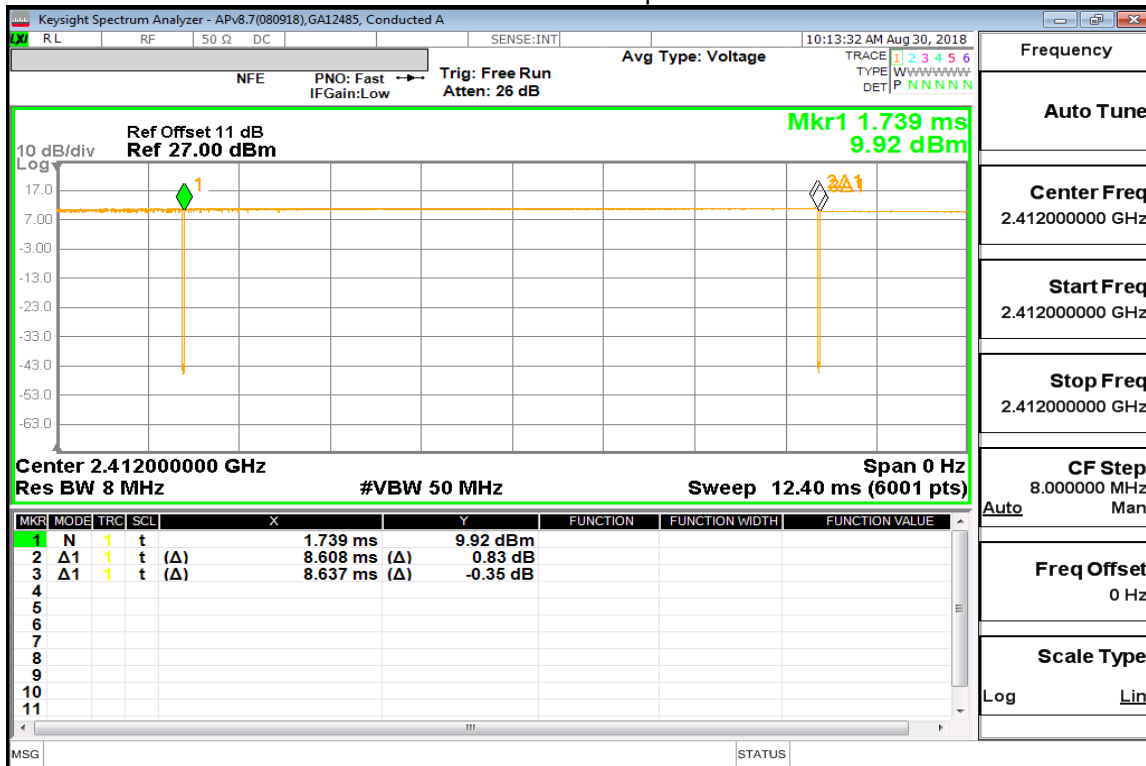
- SAR testing is not required for OFDM modes when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is  $\leq 1.2$  W/kg.
- For "Not required", SAR Test reduction was applied in accordance with KDB 248227 §2.1, b), 1).
- Channels 2, 6 and 10 for Maximum average power, were chosen for SAR evaluation due to these channels having highest Tune-up power.

#### Duty Factor Measured Results

Mode	Type	T on (ms)	Period (ms)	Duty Cycle	Crest Factor (1/duty_cycle)
802.11b	1 Mbps	8.608	8.637	99.66%	1.00

### Duty Cycle plot

802.11b 1Mbps



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

#### Wi-Fi 5 GHz Measured Results

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	16.1	16.5	Yes	Not Required	11.0	No
			40	5200	16.0	16.5			11.0	
			44	5220	16.0	16.5			11.0	
			48	5240	16.2	16.5			11.0	
	802.11n (HT20)	6.5 Mbps	36	5180	Not Required	16.5	No	Not Required	11.0	No
			40	5200		16.5			11.0	
			44	5220		16.5			11.0	
			48	5240		16.5			11.0	
	802.11ac (VHT20)	6.5 Mbps	36	5180	Not Required	16.5	No	Not Required	11.0	No
			40	5200		16.5			11.0	
			44	5220		16.5			11.0	
			48	5240		16.5			11.0	
	802.11n (HT40)	13.5 Mbps	38	5190	Not Required	15.0	No	Not Required	11.0	No
			46	5230		15.0			11.0	
802.11ac (VHT40)	13.5 Mbps	38	5190	Not Required	15.0	No	Not Required	11.0	No	
		46	5230		15.0			11.0		
802.11ac (VHT80)	29.3 Mbps	42	5210	Not Required	11.0	No	10.8	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	15.9	16.5	Yes	Not Required	11.0	No
			56	5280	16.2	16.5			11.0	
			60	5300	15.7	16.5			11.0	
			64	5320	16.4	16.5			11.0	
	802.11n (HT20)	6.5 Mbps	52	5260	Not Required	16.5	No	Not Required	11.0	No
			56	5280		16.5			11.0	
			60	5300		16.5			11.0	
			64	5320		16.5			11.0	
	802.11ac (VHT20)	6.5 Mbps	52	5260	Not Required	16.5	No	Not Required	11.0	No
			56	5280		16.5			11.0	
			60	5300		16.5			11.0	
			64	5320		16.5			11.0	
	802.11n (HT40)	13.5 Mbps	54	5270	Not Required	15.0	No	Not Required	11.0	No
			62	5310		15.0			11.0	
802.11ac (VHT40)	13.5 Mbps	54	5270	Not Required	15.0	No	Not Required	11.0	No	
		62	5310		15.0			11.0		
802.11ac (VHT80)	29.3 Mbps	58	5290	Not Required	14.0	No	10.8	11.0	Yes	

**Note(s):**

- For "Not required", SAR Test reduction was applied in accordance with KDB 248227 §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 802.11a/g/n/ac 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.
- 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.
- When the specified maximum output power is the same for both U-NII band 1 and U-NII band 2A, begin SAR measurement in U-NII band 2A; and if the highest reported SAR for U-NII band 2A is
  - ≤ 1.2 W/kg, SAR is not required for U-NII band 1
  - > 1.2 W/kg, both bands should be tested independently for SAR.
- Wi-Fi Direct is supported in U-NII Band 1. Therefore, Wi-Fi Direct was tested separately for SAR for U-NII Band 1.



**Wi-Fi 5 GHz Measured Results (continued)**

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	16.5	Yes	Not Required	11.0	No
			116	5580	15.6	16.5			11.0	
			124	5620	15.6	16.5			11.0	
			140	5700	15.6	16.5			11.0	
			144	5720	15.5	16.5			11.0	
	802.11n (HT20)	6.5 Mbps	100	5500	Not Required	16.5	No	Not Required	11.0	No
			116	5580		16.5			11.0	
			124	5620		16.5			11.0	
			140	5700		16.5			11.0	
			144	5720		16.5			11.0	
	802.11ac (VHT20)	6.5 Mbps	100	5500	Not Required	16.5	No	Not Required	11.0	No
			116	5580		16.5			11.0	
			124	5620		16.5			11.0	
			140	5700		16.5			11.0	
			144	5720		16.5			11.0	
	802.11n (HT40)	13.5 Mbps	102	5510	Not Required	15.0	No	Not Required	11.0	No
			118	5590		15.0			11.0	
			126	5630		15.0			11.0	
			134	5670		15.0			11.0	
			142	5710		15.0			11.0	
	802.11ac (VHT40)	13.5 Mbps	102	5510	Not Required	15.0	No	Not Required	11.0	No
			118	5590		15.0			11.0	
			126	5630		15.0			11.0	
			134	5670		15.0			11.0	
142			5710	15.0		11.0				
802.11ac (VHT80)	29.3 Mbps	106	5530	Not Required	14.0	No	10.4	11.0	Yes	
		122	5610		14.0		10.5	11.0		
		138	5690		14.0		10.4	11.0		
Band	Mode	Data Rate	Ch #	Freq. (MHz)	Maximum Average Power (dBm)			Reduced Average Power (dBm)		
UNII-3 5.8 GHz	802.11a	6 Mbps	149	5745	14.9	16.5	Yes	Not Required	11.0	No
			157	5785	15.0	16.5			11.0	
			165	5825	15.1	16.5			11.0	
	802.11n (HT20)	6.5 Mbps	149	5745	Not Required	16.5	No	Not Required	11.0	No
			157	5785		16.5			11.0	
			165	5825		16.5			11.0	
	802.11ac (VHT20)	6.5 Mbps	149	5745	Not Required	16.5	No	Not Required	11.0	No
			157	5785		16.5			11.0	
			165	5825		16.5			11.0	
	802.11n (HT40)	13.5 Mbps	151	5755	Not Required	15.0	No	Not Required	11.0	No
			159	5795		15.0			11.0	
	802.11ac (VHT40)	13.5 Mbps	151	5755	Not Required	15.0	No	Not Required	11.0	No
			159	5795		15.0			11.0	
	802.11ac (VHT80)	29.3 Mbps	155	5775	Not Required	14.0	No	10.5	11.0	Yes

**Note(s):**

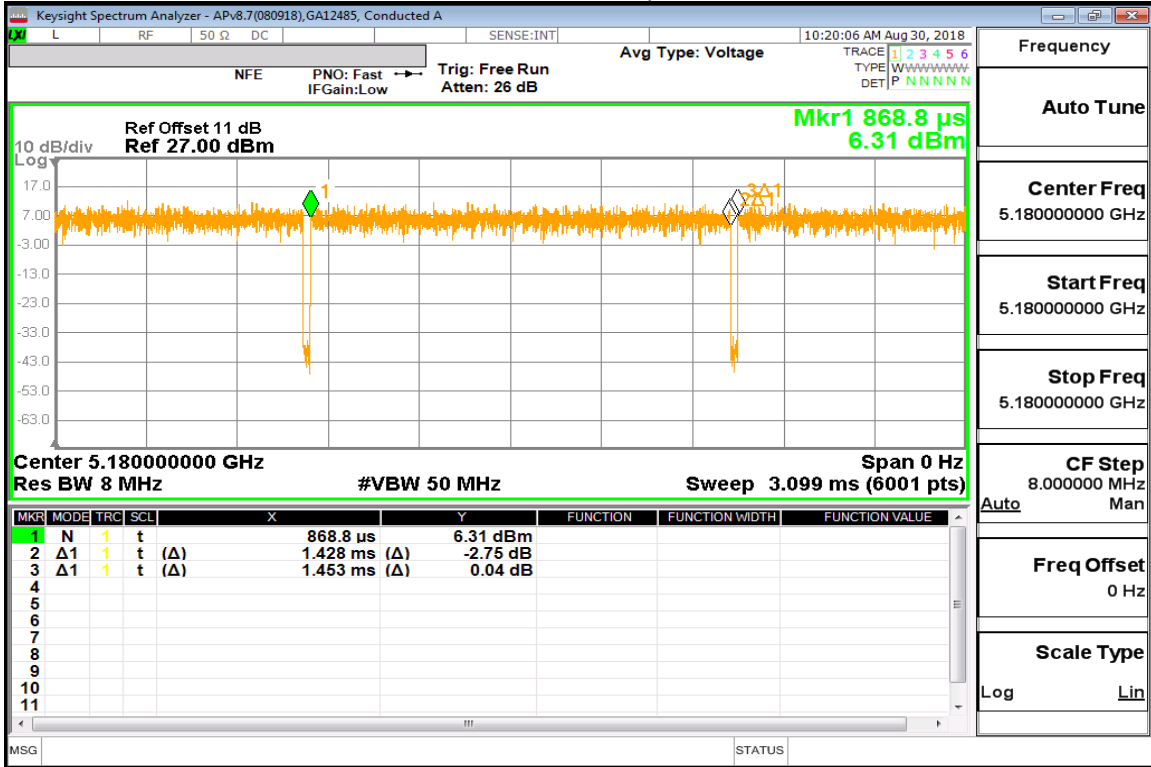
- For "Not required", SAR Test reduction was applied in accordance with KDB 248227 §2.1, b), 1). When the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11a/g/n/ac mode 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.
- 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.

**Duty Factor Measured Results**

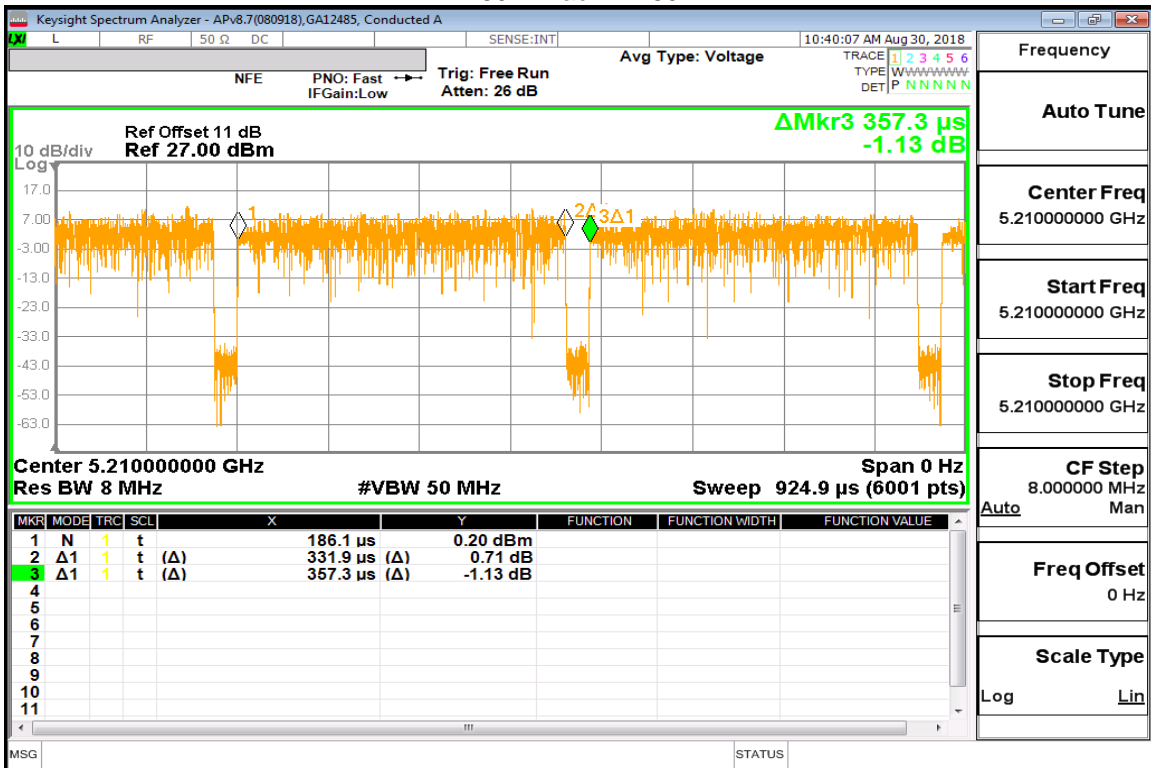
Mode	Type	T on (ms)	Period (ms)	Duty Cycle	Crest Factor (1/duty cycle)
802.11a	6 Mbps	1.428	1.453	98.28%	1.02
802.11ac	VHT80	0.332	0.357	92.89%	1.08

### Duty Cycle plots

802.11a 6 Mbps



802.11ac VHT80



## 9.7. Bluetooth

### Bluetooth Measured Results

Band	Mode	Ch #	Freq. (MHz)	Maximum Average Power (dBm)		
				Meas Pwr	Tune-up	SAR Test (Yes/No)
2.4	GFSK	0	2402	8.1	10.00	Yes
		39	2441	8.3	10.00	
		78	2480	7.6	10.00	
	EDR, $\pi/4$ DQPSK	0	2402	7.4	10.00	No
		39	2441	7.8	10.00	
		78	2480	7.1	10.00	
	EDR, 8-DPSK	0	2402	6.7	10.00	No
		39	2441	7.2	10.00	
		78	2480	6.5	10.00	
	LE, GFSK	0	2402	4.2	5.00	No
		19	2440	4.9	5.00	
		39	2480	4.4	5.00	

**Note(s):**

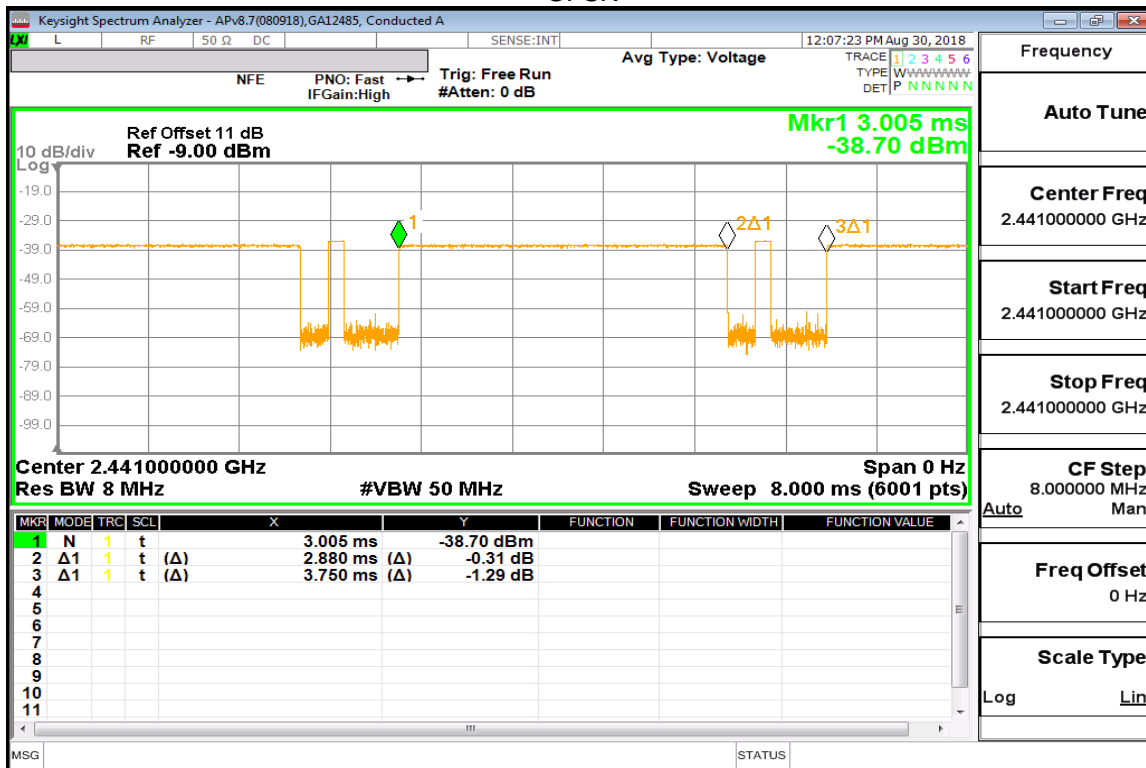
Body-worn and BT Tethering Mode qualify for SAR Test Exclusion. Refer to §10.17.

### Duty Factor Measured Results

Mode	Type	T on (ms)	Period (ms)	Duty Cycle	Crest Factor (1/duty cycle)
GFSK	DH5	2.88	3.75	76.80%	1.30

### Duty Cycle plot

GFSK



## 10. Measured and Reported (Scaled) SAR Results

### SAR Test Reduction criteria are as follows:

- Reported SAR(W/kg) for WWAN = Measured SAR \*Tune-up Scaling Factor
- Reported SAR(W/kg) for Wi-Fi and Bluetooth = 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:

- $\leq 0.8$  W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is  $\leq 100$  MHz
- $\leq 0.6$  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
- $\leq 0.4$  W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is  $\geq 200$  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):

When hotspot mode does not apply, 10-g Extremity SAR is required for all surfaces and edges with an antenna located at  $\leq 25$  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 .

Per TCB workshop April 2016; Page 22, RF Exposure Procedures (Phablet Procedures): phablet 10-g SAR should not be identified as hand or extremity SAR; this should be reported as product specific 10-g SAR in reports and grants.

### 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  $\leq \frac{1}{4}$  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  $\leq 1.2$  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.

### 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.

**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 2 Slots	OFF	0	Left Touch	190	836.6	32.0	30.5	0.014	0.020	1
				Left Tilt	190	836.6	32.0	30.5	0.010	0.014	
				Right Touch	190	836.6	32.0	30.5	0.020	<b>0.028</b>	
				Right Tilt	190	836.6	32.0	30.5	0.010	0.014	
Body-worn	GPRS 2 Slots	OFF	15	Rear	190	836.6	32.0	30.5	0.019	<b>0.027</b>	2
				Front	190	836.6	32.0	30.5	0.014	0.020	
Hotspot	GPRS 2 Slots	OFF	10	Rear	190	836.6	32.0	30.5	0.046	<b>0.065</b>	3
				Front	190	836.6	32.0	30.5	0.016	0.023	
				Edge 3	190	836.6	32.0	30.5	0.021	0.030	
				Edge 4	190	836.6	32.0	30.5	0.005	0.007	

**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 2 Slots	OFF	0	Left Touch	661	1880.0	28.5	27.2	0.085	<b>0.116</b>	4
				Left Tilt	661	1880.0	28.5	27.2	0.030	0.041	
				Right Touch	661	1880.0	28.5	27.2	0.050	0.068	
				Right Tilt	661	1880.0	28.5	27.2	0.031	0.042	
Body-worn	GPRS 2 Slots	OFF	15	Rear	661	1880.0	28.5	27.2	0.092	<b>0.126</b>	5
				Front	661	1880.0	28.5	27.2	0.065	0.089	
Hotspot	GPRS 2 Slots	OFF	10	Rear	661	1880.0	28.5	27.2	0.194	<b>0.265</b>	6
				Front	661	1880.0	28.5	27.2	0.150	0.205	
				Edge 3	661	1880.0	28.5	27.2	0.100	0.136	
				Edge 4	661	1880.0	28.5	27.2	0.090	0.123	

**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	9400	1880.0	24.5	23.3	0.142	<b>0.186</b>	7
				Left Tilt	9400	1880.0	24.5	23.3	0.057	0.075	
				Right Touch	9400	1880.0	24.5	23.3	0.083	0.109	
				Right Tilt	9400	1880.0	24.5	23.3	0.047	0.062	
Body-worn	Rel. 99 RMC 12.2 kbps	OFF	15	Rear	9400	1880.0	24.5	23.3	0.122	<b>0.160</b>	8
				Front	9400	1880.0	24.5	23.3	0.105	0.138	
Hotspot	Rel. 99 RMC 12.2 kbps	OFF	10	Rear	9400	1880.0	24.5	23.3	0.276	<b>0.362</b>	9
				Front	9400	1880.0	24.5	23.3	0.246	0.323	
				Edge 3	9400	1880.0	24.5	23.3	0.139	0.182	
				Edge 4	9400	1880.0	24.5	23.3	0.137	0.180	

**10.4. W-CDMA Band IV**

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	1413	1732.6	24.5	23.1	0.348	<b>0.479</b>	10
				Left Tilt	1413	1732.6	24.5	23.1	0.156	0.215	
				Right Touch	1413	1732.6	24.5	23.1	0.173	0.238	
				Right Tilt	1413	1732.6	24.5	23.1	0.116	0.160	
Body-worn	Rel. 99 RMC 12.2 kbps	OFF	15	Rear	1413	1732.6	24.5	23.1	0.257	<b>0.354</b>	11
				Front	1413	1732.6	24.5	23.1	0.245	0.337	
Hotspot	Rel. 99 RMC 12.2 kbps	OFF	10	Rear	1413	1732.6	24.5	23.1	0.406	0.559	12
				Front	1413	1732.6	24.5	23.1	0.474	<b>0.653</b>	
				Edge 3	1413	1732.6	24.5	23.1	0.216	0.297	
				Edge 4	1413	1732.6	24.5	23.1	0.310	0.427	

**10.5. 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	24.2	0.141	0.171	13
				Left Tilt	4183	836.6	25.0	24.2	0.106	0.128	
				Right Touch	4183	836.6	25.0	24.2	0.190	<b>0.230</b>	
				Right Tilt	4183	836.6	25.0	24.2	0.104	0.126	
Body-worn	Rel. 99 RMC 12.2 kbps	OFF	15	Rear	4183	836.6	25.0	24.2	0.224	<b>0.271</b>	14
				Front	4183	836.6	25.0	24.2	0.139	0.168	
Hotspot	Rel. 99 RMC 12.2 kbps	OFF	10	Rear	4183	836.6	25.0	24.2	0.527	<b>0.638</b>	15
				Front	4183	836.6	25.0	24.2	0.185	0.224	
				Edge 3	4183	836.6	25.0	24.2	0.235	0.284	
				Edge 4	4183	836.6	25.0	24.2	0.045	0.054	

**10.6. LTE Band 2 (20MHz Bandwidth)**

RF Exposure Conditions	Mode	Power Back-off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	RB Allocation	RB offset	Power (dBm)		1-g SAR (W/kg)		Plot No.
									Tune-up limit	Meas.	Meas.	Scaled	
Head	QPSK	OFF	0	Left Touch	18900	1880.0	1	0	24.5	23.0	0.131	<b>0.185</b>	16
							50	0	23.5	22.0	0.094	0.133	
				Left Tilt	18900	1880.0	1	0	24.5	23.0	0.057	0.080	
							50	0	23.5	22.0	0.040	0.057	
				Right Touch	18900	1880.0	1	0	24.5	23.0	0.074	0.104	
							50	0	23.5	22.0	0.052	0.073	
				Right Tilt	18900	1880.0	1	0	24.5	23.0	0.032	0.045	
							50	0	23.5	22.0	0.023	0.032	
Body-worn	QPSK	OFF	15	Rear	18900	1880.0	1	0	24.5	23.0	0.154	<b>0.217</b>	17
							50	0	23.5	22.0	0.118	0.167	
				Front	18900	1880.0	1	0	24.5	23.0	0.149	0.210	
							50	0	23.5	22.0	0.109	0.154	
Hotspot	QPSK	OFF	10	Rear	18900	1880.0	1	0	24.5	23.0	0.385	<b>0.543</b>	18
							50	0	23.5	22.0	0.293	0.414	
				Front	18900	1880.0	1	0	24.5	23.0	0.334	0.471	
							50	0	23.5	22.0	0.239	0.338	
				Edge 3	18900	1880.0	1	0	24.5	23.0	0.204	0.288	
							50	0	23.5	22.0	0.145	0.205	
				Edge 4	18900	1880.0	1	0	24.5	23.0	0.165	0.233	
							50	0	23.5	22.0	0.117	0.165	

### 10.7. LTE Band 4 (20MHz Bandwidth)

SAR for LTE Band 4 (Frequency range: 1710-1755 MHz) is covered by LTE Band 66 (Frequency range: 1710-1780 MHz) due to similar frequency range, same maximum tune-up limit and same channel bandwidth.

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

RF Exposure Conditions	Mode	Power Back-off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	RB Allocation	RB offset	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	23.1	0.119	0.185	19
							25	0	24.0	22.0	0.093	0.146	
				Left Tilt	20525	836.5	1	0	25.0	23.1	0.088	0.137	
							25	0	24.0	22.0	0.069	0.108	
				Right Touch	20525	836.5	1	0	25.0	23.1	0.159	<b>0.247</b>	
							25	0	24.0	22.0	0.124	0.195	
				Right Tilt	20525	836.5	1	0	25.0	23.1	0.089	0.138	
							25	0	24.0	22.0	0.070	0.110	
Body-worn	QPSK	OFF	15	Rear	20525	836.5	1	0	25.0	23.1	0.201	<b>0.313</b>	20
							25	0	24.0	22.0	0.161	0.253	
				Front	20525	836.5	1	0	25.0	23.1	0.118	0.183	
							25	0	24.0	22.0	0.090	0.141	
Hotspot	QPSK	OFF	10	Rear	20525	836.5	1	0	25.0	23.1	0.417	<b>0.648</b>	21
							25	0	24.0	22.0	0.345	0.541	
				Front	20525	836.5	1	0	25.0	23.1	0.129	0.201	
							25	0	24.0	22.0	0.108	0.169	
				Edge 3	20525	836.5	1	0	25.0	23.1	0.173	0.269	
							25	0	24.0	22.0	0.141	0.221	
				Edge 4	20525	836.5	1	0	25.0	23.1	0.041	0.064	
							25	0	24.0	22.0	0.031	0.049	

### 10.9. LTE Band 12 (10MHz Bandwidth)

RF Exposure Conditions	Mode	Power Back-off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	RB Allocation	RB offset	Power (dBm)		1-g SAR (W/kg)		Plot No.
									Tune-up limit	Meas.	Meas.	Scaled	
Head	QPSK	OFF	0	Left Touch	23095	707.5	1	0	25.0	23.1	0.079	0.124	22
							25	0	24.0	22.1	0.047	0.073	
				Left Tilt	23095	707.5	1	0	25.0	23.1	0.047	0.073	
							25	0	24.0	22.1	0.045	0.070	
				Right Touch	23095	707.5	1	0	25.0	23.1	0.093	<b>0.146</b>	
							25	0	24.0	22.1	0.085	0.132	
				Right Tilt	23095	707.5	1	0	25.0	23.1	0.047	0.073	
							25	0	24.0	22.1	0.045	0.071	
Body-worn	QPSK	OFF	15	Rear	23095	707.5	1	0	25.0	23.1	0.257	<b>0.403</b>	23
							25	0	24.0	22.1	0.191	0.299	
				Front	23095	707.5	1	0	25.0	23.1	0.179	0.280	
							25	0	24.0	22.1	0.154	0.241	
Hotspot	QPSK	OFF	10	Rear	23095	707.5	1	0	25.0	23.1	0.316	<b>0.495</b>	24
							25	0	24.0	22.1	0.263	0.412	
				Front	23095	707.5	1	0	25.0	23.1	0.158	0.248	
							25	0	24.0	22.1	0.123	0.193	
				Edge 3	23095	707.5	1	0	25.0	23.1	0.063	0.099	
							25	0	24.0	22.1	0.064	0.100	
				Edge 4	23095	707.5	1	0	25.0	23.1	0.151	0.237	
							25	0	24.0	22.1	0.139	0.218	



**10.10. LTE Band 13 (10MHz Bandwidth)**

RF Exposure Conditions	Mode	Power Back-off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	RB Allocation	RB offset	Power (dBm)		1-g SAR (W/kg)		Plot No.
									Tune-up limit	Meas.	Meas.	Scaled	
Head	QPSK	OFF	0	Left Touch	23230	782.0	1	0	24.5	22.9	0.027	0.039	
							25	0	23.5	21.8	0.020	0.029	
				Left Tilt	23230	782.0	1	0	24.5	22.9	0.021	0.030	
							25	0	23.5	21.8	0.016	0.024	
				Right Touch	23230	782.0	1	0	24.5	22.9	0.037	<b>0.053</b>	25
							25	0	23.5	21.8	0.029	0.043	
				Right Tilt	23230	782.0	1	0	24.5	22.9	0.021	0.030	
							25	0	23.5	21.8	0.016	0.024	
Body-worn	QPSK	OFF	15	Rear	23230	782.0	1	0	24.5	22.9	0.091	<b>0.130</b>	26
							25	0	23.5	21.8	0.071	0.105	
				Front	23230	782.0	1	0	24.5	22.9	0.051	0.073	
							25	0	23.5	21.8	0.040	0.059	
Hotspot	QPSK	OFF	10	Rear	23230	782.0	1	0	24.5	22.9	0.214	<b>0.306</b>	27
							25	0	23.5	21.8	0.173	0.255	
				Front	23230	782.0	1	0	24.5	22.9	0.066	0.094	
							25	0	23.5	21.8	0.052	0.077	
				Edge 3	23230	782.0	1	0	24.5	22.9	0.077	0.110	
							25	0	23.5	21.8	0.060	0.088	
				Edge 4	23230	782.0	1	0	24.5	22.9	0.010	0.014	
							25	0	23.5	21.8	0.007	0.010	

**10.11. LTE Band 17 (10MHz Bandwidth)**

SAR for LTE Band 17 (Frequency Range: 704-716 MHz) is covered by LTE Band 12 (Frequency Range: 699-716 MHz) due to overlapping frequency range, same maximum tune-up limit and same channel bandwidth.

**10.12. LTE Band 41 (20MHz Bandwidth)**

RF Exposure Conditions	Mode	Power Back-off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	RB Allocation	RB offset	Power (dBm)		1-g SAR (W/kg)		Plot No.
									Tune-up limit	Meas.	Meas.	Scaled	
Head	QPSK	OFF	0	Left Touch	40620	2593.0	1	99	24.5	23.1	0.194	0.265	
							50	24	23.5	22.2	0.146	0.198	
				Left Tilt	40620	2593.0	1	99	24.5	23.1	0.141	0.193	
							50	24	23.5	22.2	0.111	0.150	
				Right Touch	40620	2593.0	1	99	24.5	23.1	0.298	<b>0.408</b>	28
							50	24	23.5	22.2	0.220	0.298	
				Right Tilt	40620	2593.0	1	99	24.5	23.1	0.082	0.112	
							50	24	23.5	22.2	0.043	0.058	
Body-worn	QPSK	OFF	15	Rear	40620	2593.0	1	99	24.5	23.1	0.236	<b>0.323</b>	29
							50	24	23.5	22.2	0.182	0.247	
				Front	40620	2593.0	1	99	24.5	23.1	0.166	0.227	
							50	24	23.5	22.2	0.124	0.168	
Hotspot	QPSK	OFF	10	Rear	40620	2593.0	1	99	24.5	23.1	0.453	<b>0.620</b>	30
							50	24	23.5	22.2	0.357	0.484	
				Front	40620	2593.0	1	99	24.5	23.1	0.361	0.494	
							50	24	23.5	22.2	0.274	0.371	
				Edge 2	40620	2593.0	1	99	24.5	23.1	0.356	0.487	
							50	24	23.5	22.2	0.277	0.375	
				Edge 3	40620	2593.0	1	99	24.5	23.1	0.126	0.172	
							50	24	23.5	22.2	0.095	0.129	

### 10.13. LTE Band 66 (20MHz Bandwidth)

RF Exposure Conditions	Mode	Power Back-off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	RB Allocation	RB offset	Power (dBm)		1-g SAR (W/kg)		Plot No.
									Tune-up limit	Meas.	Meas.	Scaled	
Head	QPSK	OFF	0	Left Touch	132322	1745.0	1	0	24.5	22.7	0.409	<b>0.620</b>	31
							50	0	23.5	21.7	0.329	0.499	
				Left Tilt	132322	1745.0	1	0	24.5	22.7	0.203	0.308	
							50	0	23.5	21.7	0.164	0.249	
				Right Touch	132322	1745.0	1	0	24.5	22.7	0.228	0.345	
							50	0	23.5	21.7	0.189	0.286	
				Right Tilt	132322	1745.0	1	0	24.5	22.7	0.127	0.192	
							50	0	23.5	21.7	0.101	0.153	
Body-worn	QPSK	OFF	15	Rear	132322	1745.0	1	0	24.5	22.7	0.283	0.429	
							50	0	23.5	21.7	0.206	0.312	
				Front	132322	1745.0	1	0	24.5	22.7	0.308	<b>0.467</b>	32
							50	0	23.5	21.7	0.241	0.365	
Hotspot	QPSK	OFF	10	Rear	132072	1720.0	1	0	24.5	22.5	0.589	<b>0.923</b>	33
					132322	1745.0	1	0	24.5	22.7	0.594	0.900	
					50	0	23.5	21.7	0.490	0.743			
				Front	132072	1720.0	1	0	24.5	22.55	0.481	0.754	
					132322	1745.0	1	0	24.5	22.7	0.587	0.889	
					50	0	23.5	21.7	0.459	0.696			
				Edge 3	132322	1745.0	1	0	24.5	22.50	0.555	0.880	
							50	0	23.5	21.7	0.459	0.696	
							1	0	24.5	22.7	0.303	0.459	
				Edge 4	132322	1745.0	1	0	24.5	22.7	0.414	0.627	
							50	0	23.5	21.7	0.324	0.491	

### 10.14. 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	1	2412.0	99.66%	0.359	13.0	12.8			
				Left Tilt	1	2412.0	99.66%	0.400	13.0	12.8			
				Right Touch	1	2412.0	99.66%	0.539	13.0	12.8	0.380	0.399	
				Right Tilt	1	2412.0	99.66%	<b>0.665</b>	13.0	12.8	0.455	<b>0.478</b>	34
Body-worn	802.11b 1 Mbps	OFF	15	Rear	6	2437.0	99.66%	<b>0.310</b>	19.0	18.6	0.215	<b>0.237</b>	35
				Front	6	2437.0	99.66%	0.209	19.0	18.6			
Hotspot & Wi-Fi Direct	802.11b 1 Mbps	OFF	10	Rear	6	2437.0	99.66%	<b>0.656</b>	19.0	18.6	0.476	<b>0.524</b>	36
				Front	6	2437.0	99.66%	0.464	19.0	18.6	0.313	0.344	
				Edge 1	6	2437.0	99.66%	0.416	19.0	18.6			
				Edge 4	6	2437.0	99.66%	0.103	19.0	18.6			

#### Adjusted SAR for OFDM Modes:

Power Back-off	802.11b Max. Power		802.11g Max. Power		802.11n HT20 Max. Power		Highest Reported SAR for 802.11b (W/kg)	Adjusted SAR for 802.11g (W/kg)	Adjusted SAR for 802.11n HT20 (W/kg)
	dBm	mW	dBm	mW	dBm	mW			
ON	13.0	20	13.0	20	13.0	20	0.478	0.478	0.478
OFF	19.0	79	17.0	50	17.0	50	0.524	0.331	0.331

#### Note(s):

Adjusted SAR for OFDM modes is < 1.2 W/kg, therefore SAR testing is not required for OFDM modes.

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

### UNII-1 & 2A

When the specified maximum output power is the same for both UNII band 1 and UNII band 2A, begin SAR measurement in UNII band 2A; and if the highest reported SAR for UNII band 2A is

- $\leq 1.2$  or 3 W/kg (1g and 10g respectively), SAR is not required for UNII band 1
- $> 1.2$  or 3 W/kg (1g and 10g respectively), 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	
Wi-Fi Direct	802.11a 6 Mbps	OFF	10	Rear	48	5240.0	98.28%	<b>0.433</b>	16.5	16.2	0.214	<b>0.233</b>	37
				Front	48	5240.0	98.28%	0.276	16.5	16.2			
				Edge 1	48	5240.0	98.28%	0.011	16.5	16.2			
				Edge 4	48	5240.0	98.28%	0.055	16.5	16.2			

#### Note(s):

Wi-Fi Direct is supported in U-NII Band 1, therefore it was evaluated separately.

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	5290.0	92.89%	0.441	11.0	10.8			
				Left Tilt	58	5290.0	92.89%	0.454	11.0	10.8			
				Right Touch	58	5290.0	92.89%	0.557	11.0	10.8			
				Right Tilt	58	5290.0	92.89%	<b>0.638</b>	11.0	10.8	0.269	<b>0.303</b>	38
Body-worn	802.11a 6 Mbps	OFF	15	Rear	64	5320.0	98.28%	<b>0.356</b>	16.5	16.4	0.159	0.166	39
				Front	64	5320.0	98.28%	0.283	16.5	16.4			

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	802.11a 6 Mbps	OFF	0	Rear	64	5320.0	98.28%	5.200	16.5	16.4			
				Front	64	5320.0	98.28%	3.750	16.5	16.4			
				Edge 1	64	5320.0	98.28%	<b>5.820</b>	16.5	16.4	0.524	<b>0.546</b>	40
				Edge 4	64	5320.0	98.28%	0.133	16.5	16.4			

#### Note(s):

1. For Head and Body-worn RF Exposure Conditions, The Highest Reported 1-g SAR for U-NII 2A mode is  $< 1.2$  W/kg, therefore SAR testing is not required for U-NII 1 mode.
2. For Product Specific 10g RF Exposure Condition, The Highest Reported 10-g SAR for U-NII 2A mode is  $< 3.0$  W/kg, therefore SAR testing is not required for U-NII 1 mode.

### U-NII 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	5610.0	92.89%	0.642	11.0	10.5			
				Left Tilt	122	5610.0	92.89%	<b>0.928</b>	11.0	10.5	0.360	0.435	
				Right Touch	122	5610.0	92.89%	0.891	11.0	10.5	0.373	<b>0.451</b>	41
				Right Tilt	122	5610.0	92.89%	0.625	11.0	10.5			
Body-worn	802.11a 6 Mbps	OFF	15	Rear	100	5500.0	98.28%	<b>0.349</b>	16.5	16.0	0.158	<b>0.180</b>	42
				Front	100	5500.0	98.28%	0.281	16.5	16.0			

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	802.11a 6 Mbps	OFF	0	Rear	100	5500.0	98.28%	<b>4.890</b>	16.5	16.0	0.460	<b>0.525</b>	43
				Front	100	5500.0	98.28%	2.050	16.5	16.0			
				Edge 1	100	5500.0	98.28%	4.250	16.5	16.0			
				Edge 4	100	5500.0	98.28%	0.130	16.5	16.0			

**U-NII 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	92.89%	0.791	11.0	10.5			
				Left Tilt	155	5775	92.89%	0.827	11.0	10.5			
				Right Touch	155	5775	92.89%	1.080	11.0	10.5	0.448	0.541	
				Right Tilt	155	5775	92.89%	<b>1.140</b>	11.0	10.5	0.456	<b>0.551</b>	44
Body-worn	802.11a 6 Mbps	OFF	15	Rear	165	5825	98.28%	<b>0.403</b>	16.5	15.1	0.176	<b>0.247</b>	45
				Front	165	5825	98.28%	0.300	16.5	15.1			
Hotspot & Wi-Fi Direct	802.11a 6 Mbps	OFF	10	Rear	165	5825	98.28%	0.615	16.5	15.1	0.264	0.371	
				Front	165	5825	98.28%	0.404	16.5	15.1			
				Edge 1	165	5825	98.28%	<b>0.948</b>	16.5	15.1	0.403	<b>0.566</b>	46
				Edge 4	165	5825	98.28%	0.096	16.5	15.1			

**10.16. Bluetooth**

RF Exposure Conditions	Mode	Power Back-off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		Plot No.
								Tune-up limit	Meas.	Meas.	Scaled	
Head	GFSK DH5	OFF	0	Left Touch	39	2441	76.80%	10.0	8.3	0.059	0.113	
				Left Tilt	39	2441	76.80%	10.0	8.3	0.066	0.126	
				Right Touch	39	2441	76.80%	10.0	8.3	0.124	0.237	
				Right Tilt	39	2441	76.80%	10.0	8.3	0.133	<b>0.254</b>	47

**Note(s):**

Body-worn and BT Tethering Mode qualify for SAR Test Exclusion. Refer to §10.17.

### 10.17. Standalone SAR Test Exclusion Considerations & Estimated SAR

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$ , for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

- $f_{(\text{GHz})}$  is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

When the standalone SAR test exclusion is applied to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:

- $(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f_{(\text{GHz})}/x}] \text{ W/kg}$  for test separation distances ≤ 50 mm; where  $x = 7.5$  for 1-g SAR, and  $x = 18.75$  for 10-g SAR.
- 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the test separation distances is > 50 mm.

#### Body-worn and BT Tethering:

RF Air interface	RF Exposure Conditions	Frequency (GHz)	Max. tune-up tolerance Power		Min. test separation distance (mm)	SAR test exclusion Result*	Estimated 1-g SAR (W/kg)
			(dBm)	(mW)			
Bluetooth	Body-worn	2.480	10.0	10	15	1.0	0.140
Bluetooth	Tethering	2.480	10.0	10	10	1.6	0.210

#### Conclusion:

\*: The computed value is ≤ 3; therefore, this qualifies for Standalone SAR test exclusion.

## 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  $\geq 0.8$  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  $\geq 1.45$  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  $\geq 1.5$  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  $> 1.20$ .

Frequency Band (MHz)	Air Interface	RF Exposure Conditions	Test Position	Repeated SAR (Yes/No)	Highest Measured SAR (W/kg)
700	LTE Band 12	Hotspot	Rear	No	0.316
	LTE Band 13	Hotspot	Rear	No	0.214
850	GSM 850	Hotspot	Rear	No	0.046
	WCDMA Band V	Hotspot	Rear	No	0.527
	LTE Band 5	Hotspot	Rear	No	0.417
1700	WCDMA Band IV	Hotspot	Front	No	0.474
	LTE Band 66	Hotspot	Rear	No	0.594
1900	GSM 1900	Hotspot	Rear	No	0.194
	WCDMA Band II	Hotspot	Rear	No	0.276
	LTE Band 2	Hotspot	Rear	No	0.385
2400	Wi-Fi 802.11b	Hotspot & Wi-Fi Direct	Rear	No	0.476
	BT	Head	Right Tilt	No	0.133
2600	LTE Band 41	Hotspot	Rear	No	0.453
5200	Wi-Fi 802.11a	Wi-Fi Direct	Rear	No	0.214
5300	Wi-Fi 802.11ac	Head	Right Tilt	No	0.269
5500	Wi-Fi 802.11ac	Head	Right Tilt	No	0.373
5800	Wi-Fi 802.11ac	Head	Right Tilt	No	0.456

### Note(s):

Repeated Measurement is not required since measured SAR is  $< 0.8$  W/kg.

### Product Specific 10g SAR:

Frequency Band (MHz)	Air Interface	RF Exposure Conditions	Test Position	Repeated SAR (Yes/No)	Highest Measured SAR (W/kg)
5300	Wi-Fi 802.11a	Product Specific 10g	Edge 1	No	0.524
5500	Wi-Fi 802.11a	Product Specific 10g	Rear	No	0.460

### Note(s):

Repeated Measurement is not required since measured SAR is  $< 2.0$  W/kg.

## 12. Simultaneous Transmission Conditions

Simultaneous Transmission Scenarios

No.	Capable Transmit Configuration	Head	Body-Worn Accessory	Wireless Router	Notes
1	GSM voice + 2.4 GHz Wi-Fi	Yes	Yes	N/A	
2	GSM voice + 5 GHz Wi-Fi	Yes	Yes	N/A	
3	GSM voice + 2.4 GHz Bluetooth	Yes <sup>^</sup>	Yes	N/A	<sup>^</sup> Bluetooth Tethering is considered
4	UMTS + 2.4 GHz Wi-Fi	Yes	Yes	Yes	
5	UMTS + 5 GHz Wi-Fi	Yes	Yes	Yes	
6	UMTS + 2.4 GHz Bluetooth	Yes <sup>^</sup>	Yes	Yes <sup>^</sup>	<sup>^</sup> Bluetooth Tethering is considered
7	LTE + 2.4 GHz Wi-Fi	Yes	Yes	Yes	
8	LTE + 5 GHz Wi-Fi	Yes	Yes	Yes	
9	LTE + 2.4 GHz Bluetooth	Yes <sup>^</sup>	Yes	Yes <sup>^</sup>	<sup>^</sup> Bluetooth Tethering is considered
10	GPRS/EDGE + 2.4 GHz Wi-Fi	N/A	N/A	Yes	
11	GPRS/EDGE + 5 GHz Wi-Fi	N/A	N/A	Yes	
12	GPRS/EDGE + 2.4 GHz Bluetooth	N/A	N/A	Yes <sup>^</sup>	

### 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	Test Position	Standalone SAR (W/kg)				Σ 1-g SAR (W/kg)		
		WWAN ①	DTS ②	U-NII ③	BT	WWAN + DTS +	WWAN + U-NII +	WWAN + BT +
Head	Left Touch	0.620	0.399	0.541	0.113	1.019	1.161	0.733
	Left Tilt	0.308	0.399	0.435	0.126	0.707	0.743	0.434
	Right Touch	0.408	0.399	0.541	0.237	0.807	0.949	0.645
	Right Tilt	0.192	0.478	0.551	0.254	0.670	0.743	0.446
Body-worn	Rear	0.429	0.237	0.247	0.140	0.666	0.676	0.569
	Front	0.467	0.237	0.247	0.140	0.704	0.714	0.607
Hotspot, Wi-Fi Direct & BT Tethering	Rear	0.923	0.524	0.371	0.210	1.447	1.294	1.133
	Front	0.889	0.344	0.371	0.210	1.233	1.260	1.099
	Edge 1		0.344	0.566	0.210			0.210
	Edge 2	0.487						
	Edge 3	0.459						
	Edge 4	0.627	0.344	0.371	0.210	0.971	0.998	0.837

**Conclusion:**

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

## **Appendixes**

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

**12440598-S1V1 Appendix A: SAR Setup Photos**

**12440598-S1V1 Appendix B: SAR System Check Plots**

**12440598-S1V1 Appendix C: Highest SAR Test Plots**

**12440598-S1V1 Appendix D: SAR Liquid Tissue Ingredients**

**12440598-S1V1 Appendix E: SAR Probe Calibration Certificates**

**12440598-S1V1 Appendix F: SAR Dipole Calibration Certificates**

**END OF REPORT**