



SAR EVALUATION REPORT

IEEE Std 1528-2013

For

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

FCC ID: A3LSMG398FN

Model Name: SM-G398FN/DS, SM-G398FN

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Prepared for

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Date	Revisions	Revised By
V1	5/14/2019	Initial Issue	--
V2	5/17/2019	Section 1: Updated UNII Highest Reported SAR Section 4.3: Updated Cal due dates Appendix A: Updated Antenna Locations and Dist. illustration	Coltyce Sanders

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1. Attestation of Test Results

Applicant Name		Samsung Electronics Co. Ltd			
FCC ID		A3LSMG398FN			
Model Name		SM-G398FN/DS, SM-G398FN			
Applicable Standards		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		0.929	0.403	0.053	0.121
Body-worn		0.692	0.066	0.682	0.015
Hotspot		0.911	0.115	0.925	0.025
Simultaneous TX	Head	1.198	1.198	0.982	0.982
	Body-worn	1.243	0.758	1.243	0.708
	Hotspot	1.575	1.026	1.575	0.936
Date Tested		4/22/2019 to 5/10/2019			
Test Results		Pass			

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of the U.S. government.

Approved & Released By:	Prepared By:
	
Devin Chang Senior Test Engineer UL Verification Services Inc.	AJ Newcomer Laboratory Engineer 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:

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

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

- o [TCB workshop](#) October 2015; RF Exposure Procedures (KDB 941225 D05A)
- o [TCB workshop](#) October 2016; RF Exposure Procedures (Bluetooth Duty Factor)
- o [TCB workshop](#) October 2016; RF Exposure Procedures (DUT Holder Perturbations)
- o [TCB workshop](#) May 2017; RF Exposure Procedures (Broadband Liquid Above 3 GHz)

3. Facilities and Accreditation

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

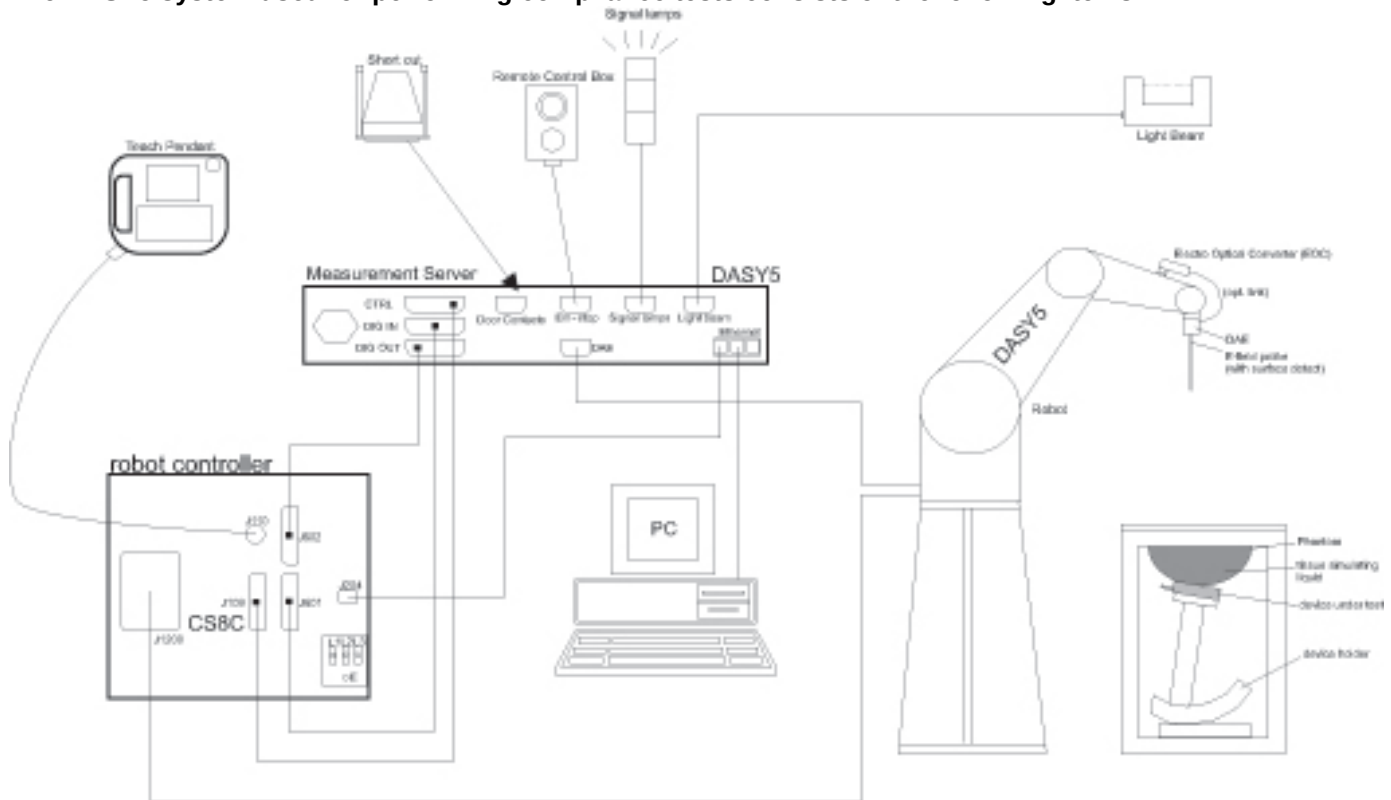
47173 Benicia Street	47266 Benicia Street
SAR Lab A	SAR Lab 1
SAR Lab B	SAR Lab 2
SAR Lab C	SAR Lab 3
SAR Lab D	SAR Lab 4
SAR Lab E	SAR Lab 5
SAR Lab F	
SAR Lab G	
SAR Lab H	

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

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

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 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: $\Delta x_{\text{Area}}, \Delta y_{\text{Area}}$	≤ 2 GHz: ≤ 15 mm $2 - 3$ GHz: ≤ 12 mm	$3 - 4$ GHz: ≤ 12 mm $4 - 6$ GHz: ≤ 10 mm
	When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be $\leq$ 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: $\Delta x_{\text{Zoom}}, \Delta y_{\text{Zoom}}$			≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{\text{Zoom}}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{\text{Zoom}}(1)$: between 1 st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{\text{Zoom}}(n>1)$: between subsequent points	$\leq 1.5 \cdot \Delta z_{\text{Zoom}}(n-1)$	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm
Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.				
* When zoom scan is required and the <i>reported</i> SAR from the <i>area scan based 1-g SAR estimation</i> procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.				

Step 4: Power drift measurement

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

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.

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Network Analyzer	R&S	ZNLE6	101273-VA	7/16/2019
Dielectric Probe kit	SPEAG	DAK-3.5	1082	9/11/2019
Shorting block	SPEAG	DAK-3.5 Short	SM DAK 200 BA	9/11/2019
Thermometer	Fisher Scientific	Traceable	140562250	3/5/2020

System Check

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

Note(s):

*Equipment not used past calibration due date.

Lab Equipment

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
E-Field Probe (SAR Lab E)	SPEAG	EX3DV4	3990	8/17/2019
E-Field Probe (SAR Lab F)	SPEAG	EX3DV4	3902	5/24/2019
E-Field Probe (SAR Lab G)	SPEAG	EX3DV4	7463	7/20/2019
E-Field Probe (SAR Lab H)	SPEAG	EX3DV4	7482	7/23/2019
Data Acquisition Electronics (SAR Lab E)	SPEAG	DAE4	1357	2/13/2020
Data Acquisition Electronics (SAR Lab F)	SPEAG	DAE4	1439	7/10/2019
Data Acquisition Electronics (SAR Lab G)	SPEAG	DAE4	1257	9/14/2019
Data Acquisition Electronics (SAR Lab H)	SPEAG	DAE4	1239	7/11/2019
System Validation Dipole	SPEAG	D835V2	4d002	11/28/2019
System Validation Dipole	SPEAG	D1900V2	5d043	11/29/2019
System Validation Dipole	SPEAG	D2450V2	899	3/22/2020
System Validation Dipole	SPEAG	D5GHzV2	1003	2/19/2020
System Validation Dipole	SPEAG	D5GHzV2	1168	11/30/2019

Other

Name of Equipment	Manufacturer	Type/Model	T Number	Serial No.	Cal. Due Date
Power Meter	Agilent	N1912A	T1263	MY55196004	1/30/2020
Power Sensor	Agilent	N1921A	T309	MY52270022	2/6/2020
Base Station Simulator	R & S	CMW500	T959	135384	2/16/2020
Base Station Simulator	R & S	CBT Bluetooth Tester	T438	100987	2/14/2020

5. Measurement Uncertainty

Per KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg and the measured 10-g SAR within a frequency band is < 3.75 W/kg. The expanded SAR measurement uncertainty must be $\leq 30\%$, 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.

Therefore, the measurement uncertainty is not required.

6. Device Under Test (DUT) Information

6.1. DUT Description

Device Dimension	This is a general size smart phone		
Back Cover	Normal Battery Cover		
Battery Options	Standard – Lithium-ion battery, Rating 3.85 Vdc, 10.78 Wh		
Accessory	Headset		
Wireless Router (Hotspot)	Wi-Fi Hotspot mode permits the device to share its cellular data connection with other Wi-Fi-enabled devices. ☒ Mobile Hotspot (Wi-Fi 2.4 GHz) ☒ Mobile Hotspot (Wi-Fi 5.8 GHz)		
Wi-Fi Direct	Wi-Fi Direct enabled devices transfer data directly between each other ☒ Wi-Fi Direct (Wi-Fi 2.4 GHz) ☒ Wi-Fi Direct (Wi-Fi 5.2/5.8 GHz)		
Bluetooth Tethering (Hotspot)	BT Tethering mode permits the device to share its cellular data connection with other devices. ☒ BT Tethering (Bluetooth 2.4 GHz)		
Test sample information	S/N	IMEI	Notes
	R38M4043KZX	356789100001161	WWAN Conducted
	R38M4044P6R	356789100013117	WLAN Conducted
	R38M40441TE	356789100006061	WWAN Radiated
	R38M40441LH	356789100005998	WWAN Radiated
	R38M40441QJ	356789100006038	WWAN Radiated
	R38M40441XP	356789100006095	WWAN Radiated
	R38M4044FHW	356789100010584	WLAN Radiated
	R38M4044F2V	356789100010436	WLAN Radiated
	R38M40AHTZP	356789100051968	WWAN Conducted/Radiated
Hardware Version	REV0.1		
Software Version	G398FN.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)	GSM Class : B Multi-Slot Class: Class 33 - 4 Up, 5 Down	GSM Voice: 12.5% (E)GPRS: 1 Slot: 12.5% 2 Slots: 25% 3 Slots: 37.5% 4 Slots: 50%	
	Does this device support DTM (Dual Transfer Mode)? ☐ Yes ☒ No				
W-CDMA (UMTS)	Band II Band V	UMTS Rel. 99 (Voice & Data) HSDPA (Cat. 24) HSUPA (Cat. 6) DC-HSDPA (Cat. 24) HSPA+ (Rel. 7) DL only		100%	
LTE	FDD Band 5	QPSK 16QAM Rel. 10 Does not support Carrier Aggregation (CA)		100% (FDD)	
	Does this device support SV-LTE (1xRTT-LTE)? ☐ Yes ☒ No				
Wi-Fi	2.4 GHz	802.11b 802.11g 802.11n (HT20)		98.67% _(802.11b) ¹	
	5 GHz	802.11a 802.11n (HT20) 802.11n (HT40) 802.11ac (VHT20) 802.11ac (VHT40) 802.11ac (VHT80)		92.44% _(802.11a) ¹ 91.99% _(802.11n 20MHz BW) ¹ 95.96% _(802.11ac 80MHz BW) ¹	
		Does this device support bands 5.60 ~ 5.65 GHz? ☒ Yes ☐ No			
		Does this device support Band gap channel(s)? ☒ Yes ☐ No			
Bluetooth	2.4 GHz	BR, EDR, LE		76.72%	

Notes:

1. Duty cycle for Wi-Fi is referenced from the DTS and UNII report.

6.3. General LTE SAR Test and Reporting Considerations

Item	Description																																																																				
Frequency range, Channel Bandwidth, Numbers and Frequencies	Band 5	Frequency range: 824 - 849 MHz (BW = 25 MHz)																																																																			
		Channel Bandwidth																																																																			
		20 MHz	15 MHz	10 MHz ¹	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																																																														
LTE transmitter and antenna implementation	Refer to Appendix A.																																																																				
Maximum power reduction (MPR)	Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 1, 2 and 3 <table><tr><th rowspan="2">Modulation</th><th colspan="6">Channel bandwidth / Transmission bandwidth (N_{RB})</th><th rowspan="2">MPR (dB)</th></tr><tr><th>1.4 MHz</th><th>3.0 MHz</th><th>5 MHz</th><th>10 MHz</th><th>15 MHz</th><th>20 MHz</th></tr><tr><td>QPSK</td><td>> 5</td><td>> 4</td><td>> 8</td><td>> 12</td><td>> 16</td><td>> 18</td><td>≤ 1</td></tr><tr><td>16 QAM</td><td>≤ 5</td><td>≤ 4</td><td>≤ 8</td><td>≤ 12</td><td>≤ 16</td><td>≤ 18</td><td>≤ 1</td></tr><tr><td>16 QAM</td><td>> 5</td><td>> 4</td><td>> 8</td><td>> 12</td><td>> 16</td><td>> 18</td><td>≤ 2</td></tr><tr><td>64 QAM</td><td>≤ 5</td><td>≤ 4</td><td>≤ 8</td><td>≤ 12</td><td>≤ 16</td><td>≤ 18</td><td>≤ 2</td></tr><tr><td>64 QAM</td><td>> 5</td><td>> 4</td><td>> 8</td><td>> 12</td><td>> 16</td><td>> 18</td><td>≤ 3</td></tr><tr><td>256 QAM</td><td colspan="6">≥ 1</td><td>≤ 5</td></tr></table> MPR Built-in by design 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							Modulation	Channel bandwidth / Transmission bandwidth (N _{RB})						MPR (dB)	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1	16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1	16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2	64 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 2	64 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 3	256 QAM	≥ 1						≤ 5
Modulation	Channel bandwidth / Transmission bandwidth (N _{RB})						MPR (dB)																																																														
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz																																																															
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1																																																														
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1																																																														
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2																																																														
64 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 2																																																														
64 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 3																																																														
256 QAM	≥ 1						≤ 5																																																														
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:

- 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.
- SAR Testing for LTE was performed with the same number of RB and RB offsets transmitting on all TTI frames (maximum TTI).

6.4. Power Back-off and Triggering Distances

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

WWAN (Hotspot), WWAN (Grip Sensor), and WWAN (Proxy + RCV) operate separately. The order of priority for when Power Back-off mode active is: WWAN (Grip Sensor) → WWAN (Proxy + RCV) → WWAN (Hotspot). However, SAR Testing for Hotspot Exposure Condition was performed using WWAN (Hotspot) Power Back-off levels because the WWAN (Hotspot) levels are higher or the same as WWAN (Grip Sensor). For a detailed description of the grip sensor refer to the WWAN sensor triggering distance data shown in the Operational Description.

WLAN back-off power supports an RCV+IR Sensor. This sensor activates in a held to ear exposure condition. When the sensor activates in this exposure condition, the output power level is reduced. For a detailed description of the RCV+IR sensor refer to the WLAN sensor triggering distance data shown in the Operational Description.

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

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

Note(s):

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

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	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	
			Edge 4 (Left)	≤ 25 mm	Yes	
WLAN	Head	0 mm	Left Touch	N/A	Yes	
			Left Tilt (15°)	N/A	Yes	
			Right Touch	N/A	Yes	
			Right Tilt (15°)	N/A	Yes	
	Body	15 mm	Rear	N/A	Yes	
			Front	N/A	Yes	
	Hotspot	10 mm	Rear	≤ 25 mm	Yes	
			Front	≤ 25 mm	Yes	
			Edge 1 (Top)	≤ 25 mm	Yes	
			Edge 2 (Right)	> 25 mm	No	1
			Edge 3 (Bottom)	> 25 mm	No	1
			Edge 4 (Left)	≤ 25 mm	Yes	

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.

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 (ϵ_r) and conductivity (σ) 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 ϵ_r and σ may be relaxed to $\pm 10\%$. This is limited to frequencies ≤ 3 GHz.

Tissue Dielectric Parameters

FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

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

IEEE Std 1528-2013

Refer to Table 3 within the IEEE Std 1528-2013

Dielectric Property Measurements Results:

SAR Lab	Date	Band (MHz)	Tissue Type	Frequency (MHz)	Relative Permittivity (ϵ_r)			Conductivity (σ)		
					Measured	Target	Delta (%)	Measured	Target	Delta (%)
E	4/24/2019	1900	Body	1900	52.97	53.30	-0.62	1.58	1.52	3.95
				1850	53.00	53.30	-0.56	1.56	1.52	2.76
				1920	52.87	53.30	-0.81	1.59	1.52	4.54
F	4/22/2019	5250	Head	5250	36.40	35.93	1.30	4.51	4.70	-4.19
				5150	36.58	36.05	1.48	4.40	4.60	-4.30
				5350	36.23	35.82	1.15	4.62	4.80	-3.80
F	4/22/2019	5600	Head	5600	35.83	35.53	0.83	4.87	5.06	-3.72
				5500	35.99	35.65	0.96	4.75	4.96	-4.15
				5725	35.59	35.39	0.56	5.03	5.19	-3.07
F	4/22/2019	5750	Head	5750	35.56	35.36	0.56	5.06	5.21	-2.93
				5700	35.66	35.42	0.68	5.00	5.16	-3.15
				5850	35.41	35.30	0.31	5.16	5.27	-2.07
F	4/25/2019	2450	Head	2450	37.90	39.20	-3.32	1.83	1.80	1.44
				2400	37.96	39.30	-3.40	1.79	1.75	1.90
				2480	37.92	39.16	-3.17	1.85	1.83	0.69
F	4/25/2019	2450	Body	2450	51.81	52.70	-1.69	2.02	1.95	3.69
				2400	51.87	52.77	-1.71	1.98	1.90	4.21
				2480	51.80	52.66	-1.64	2.04	1.99	2.60
F	5/2/2019	5600	Body	5600	47.07	48.48	-2.90	5.83	5.76	1.13
				5500	47.29	48.61	-2.72	5.66	5.64	0.31
				5725	46.76	48.31	-3.21	6.01	5.91	1.77
G	4/24/2019	835	Head	835	39.91	41.50	-3.83	0.93	0.90	3.62
				805	39.98	41.68	-4.08	0.92	0.90	2.70
				850	39.86	41.50	-3.95	0.94	0.92	2.50
G	4/24/2019	835	Body	835	55.79	55.20	1.07	0.99	0.97	2.18
				805	55.86	55.33	0.95	0.98	0.97	1.24
				850	55.74	55.16	1.06	1.00	0.99	0.96
H	4/24/2019	1900	Head	1900	39.68	40.00	-0.80	1.38	1.40	-1.43
				1850	39.74	40.00	-0.65	1.35	1.40	-3.57
				1920	39.68	40.00	-0.80	1.40	1.40	-0.21
H	5/2/2019	5750	Body	5750	46.91	48.27	-2.83	6.12	5.94	3.14
				5700	47.00	48.34	-2.78	6.05	5.88	2.93
				5850	46.73	48.20	-3.05	6.27	6.00	4.50
H	5/8/2019	5250	Body	5250	47.69	48.95	-2.58	5.31	5.35	-0.86
				5150	47.82	49.09	-2.58	5.17	5.24	-1.23
				5350	47.49	48.82	-2.72	5.48	5.47	0.17
H	5/9/2019	1900	Head	1900	39.45	40.00	-1.37	1.44	1.40	2.93
				1850	39.52	40.00	-1.20	1.42	1.40	1.14
				1920	39.45	40.00	-1.37	1.46	1.40	3.93
H	5/9/2019	1900	Body	1900	53.52	53.30	0.41	1.58	1.52	3.82
				1850	53.60	53.30	0.56	1.55	1.52	1.91
				1920	53.52	53.30	0.41	1.59	1.52	4.87

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 Date	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 $\pm 10\%$	
E	4/24/2019	Body	D1900V2 SN:5d043	11/29/2019	4.170	41.70	40.20	3.73	2.180	21.80	20.82	4.71	1,2
F	4/22/2019	Head	D5GH2V2 SN:1003 (5.25 GHz)	2/19/2020	7.520	75.20	80.80	-6.93	2.150	21.50	23.30	-7.73	3,4
F	4/22/2019	Head	D5GH2V2 SN:1003 (5.60 GHz)	2/19/2020	8.250	82.50	82.70	-0.24	2.340	23.40	23.80	-1.68	5,6
F	4/22/2019	Head	D5GH2V2 SN:1003 (5.75 GHz)	2/19/2020	7.840	78.40	80.70	-2.85	2.250	22.50	23.00	-2.17	7,8
F	4/25/2019	Head	D2450V2 SN:899	3/22/2020	5.340	53.40	51.60	3.49	2.470	24.70	24.10	2.49	9,10
F	4/25/2019	Body	D2450V2 SN:899	3/22/2020	5.110	51.10	50.00	2.20	2.360	23.60	23.50	0.43	
F	5/2/2019	Body	D5GH2V2 SN:1168 (5.60 GHz)	11/30/2019	8.130	81.30	76.20	6.69	2.270	22.70	21.20	7.08	11,12
G	4/24/2019	Head	D835V2 SN:4d002	11/28/2019	0.989	9.89	9.87	0.20	0.647	6.47	6.36	1.73	
G	4/24/2019	Body	D835V2 SN:4d002	11/28/2019	1.020	10.20	10.07	1.29	0.677	6.77	6.56	3.20	13,14
H	4/24/2019	Head	D1900V2 SN:5d043	11/29/2019	4.310	43.10	41.80	3.11	2.230	22.30	21.69	2.81	
H	5/2/2019	Body	D5GH2V2 SN:1168 (5.75 GHz)	11/30/2019	7.330	73.30	70.70	3.68	2.080	20.80	19.70	5.58	15,16
H	5/8/2019	Body	D5GH2V2 SN:1168 (5.25 GHz)	11/30/2019	7.320	73.20	71.20	2.81	2.060	20.60	19.90	3.52	17,18
H	5/9/2019	Head	D1900V2 SN:5d043	11/29/2019	4.190	41.90	41.80	0.24	2.160	21.60	21.69	-0.41	
H	5/9/2019	Body	D1900V2 SN:5d043	11/29/2019	4.290	42.90	40.20	6.72	2.210	22.10	20.82	6.15	19,20

9. Conducted Output Power Measurements

9.1. GSM

Per KDB 941225 D01 3G SAR Procedures:

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

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

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

Per October 2013 TCB Workshop:

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

Maximum Output Power (Tune-up Limit) for GSM

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

GSM850 Measured Results

Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Maximum Average Power (dBm)			
					Measured		Tune-up Limit	
					Burst Pw r	Frame Pw r	Burst Pw r	Frame Pw r
GPRS/EDGE (GMSK)	CS1	1	128	824.2	32.5	23.5	34.0	25.0
			190	836.6	32.4	23.4		
			251	848.8	32.4	23.4		
		2	128	824.2	30.1	24.1	31.0	25.0
			190	836.6	30.2	24.2		
			251	848.8	30.3	24.3		
		3	128	824.2	28.9	24.6	30.0	25.7
			190	836.6	29.0	24.7		
			251	848.8	29.1	24.8		
		4	128	824.2	27.8	24.8	28.5	25.5
			190	836.6	27.8	24.8		
			251	848.8	27.9	24.9		
EDGE (8PSK)	MCS5	1	128	824.2	26.8	17.8	28.0	19.0
			190	836.6	26.8	17.8		
			251	848.8	26.8	17.8		
		2	128	824.2	24.9	18.9	26.0	20.0
			190	836.6	24.9	18.9		
			251	848.8	24.9	18.9		
		3	128	824.2	23.6	19.3	24.5	20.2
			190	836.6	23.6	19.3		
			251	848.8	23.6	19.3		
		4	128	824.2	22.6	19.6	23.0	20.0
			190	836.6	22.6	19.6		
			251	848.8	22.6	19.6		

Notes:

GPRS/EDGE (GMSK) mode with 3 time slots for Max power, based on the Tune-up Procedure.

GSM1900 Measured Results

Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Maximum Average Power (dBm)				Hotspot/Grip Average Power (dBm)				Proxy+RCV Average Power (dBm)			
					Measured		Tune-up Limit		Measured		Tune-up Limit		Measured		Tune-up Limit	
					Burst Pwr	Frame Pwr	Burst Pwr	Frame Pwr	Burst Pwr	Frame Pwr	Burst Pwr	Frame Pwr	Burst Pwr	Frame Pwr	Burst Pwr	Frame Pwr
GPRS/EDGE (GMSK)	CS1	1	512	1850.2	29.3	20.3	31.0	22.0	27.8	18.8	29.5	20.5	28.5	19.5	30.0	21.0
			661	1880.0	29.4	20.4			28.0	19.0			28.6	19.6		
			810	1909.8	29.4	20.4			28.2	19.1			28.7	19.7		
		2	512	1850.2	26.6	20.6	28.0	22.0	25.0	19.0	26.5	20.5	25.6	19.6	27.0	21.0
			661	1880.0	26.9	20.9			25.3	19.3			25.8	19.8		
			810	1909.8	27.1	21.1			25.5	19.5			26.0	20.0		
		3	512	1850.2	24.7	20.4	26.5	22.2	23.3	19.0	25.0	20.7	24.0	19.7	25.5	21.2
			661	1880.0	24.9	20.6			23.5	19.2			24.0	19.7		
			810	1909.8	25.0	20.7			23.7	19.4			24.1	19.8		
		4	512	1850.2	23.0	20.0	25.0	22.0	21.5	18.5	23.5	20.5	22.0	19.0	24.0	21.0
			661	1880.0	23.3	20.3			21.6	18.6			22.0	19.0		
			810	1909.8	23.5	20.5			21.7	18.7			22.1	19.1		
EDGE (8PSK)	MCS5	1	512	1850.2	25.7	16.7	27.0	18.0	23.5	14.5	25.5	16.5	23.7	14.7	26.0	17.0
			661	1880.0	25.9	16.9			23.5	14.5			23.7	14.7		
			810	1909.8	26.0	17.0			23.5	14.5			23.8	14.8		
		2	512	1850.2	23.5	17.5	25.0	19.0	23.2	17.2	23.5	17.5	23.4	17.4	24.0	18.0
			661	1880.0	23.7	17.7			23.4	17.4			23.5	17.5		
			810	1909.8	23.8	17.8			23.5	17.5			23.6	17.6		
		3	512	1850.2	22.0	17.7	23.5	19.2	21.8	17.5	22.0	17.7	21.8	17.5	22.5	18.2
			661	1880.0	22.1	17.8			21.9	17.6			21.9	17.6		
			810	1909.8	22.2	17.9			22.0	17.7			22.0	17.7		
		4	512	1850.2	20.5	17.5	22.5	19.5	20.3	17.3	21.0	18.0	20.5	17.5	21.5	18.5
			661	1880.0	20.6	17.6			20.5	17.5			20.5	17.5		
			810	1909.8	20.6	17.6			20.6	17.6			20.6	17.6		

Notes:

GPRS/EDGE (GMSK) mode with 3 time slots for Max power, 3 time slots for Hotspot/Grip Sensor Reduced Power and 3 time slots for Proxy+RCV Reduced power, based on the Tune-up Procedure.

9.2. W-CDMA

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

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

Release 99 Setup Procedures used to establish the test signals

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

Mode	Subtest	Rel99
WCDMA General Settings	Loopback Mode	Test Mode 2
	Rel99 RMC	12.2kbps RMC
	Power Control Algorithm	Algorithm2
	β_c/β_d	8/15

HSDPA Setup Procedures used to establish the test signals

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

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

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{hs} (Note 1, Note 2)	CM (dB) (Note 3)	MPR (dB) (Note 3)
1	2/15	15/15	64	2/15	4/15	0.0	0.0
2	12/15 (Note 4)	15/15 (Note 4)	64	12/15 (Note 4)	24/15	1.0	0.0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5

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

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

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

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

HSUPA Setup Procedures used to establish the test signals

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

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

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{hs} (Note 1)	β_{ec}	β_{ed} (Note 4) (Note 5)	β_{ed} (SF)	β_{ed} (Codes)	CM (dB) (Note 2)	MPR (dB) (Note 2) (Note 6)	AG Index (Note 5)	E- TFCI
1	11/15 (Note 3)	15/15 (Note 3)	64	11/15 (Note 3)	22/15	209/25	1309/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	$\beta_{ed1}: 47/15$ $\beta_{ed2}: 47/15$	4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15	0	-	-	5/15	5/15	47/15	4	1	1.0	0.0	12	67

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

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

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

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

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

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

DC-HSDPA Setup Procedures used to establish the test signals

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

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

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

HSPA+ Setup Procedures used to establish the test signals

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

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

SAR measurement is not required for the HSDPA, HSUPA, and DC-HSDPA. When primary mode and the adjusted SAR is ≤ 1.2 W/kg and secondary mode is $\leq \frac{1}{4}$ dB higher than the primary mode.

W-CDMA Band II Measured Results

Mode		UL Ch No.	Freq. (MHz)	Maximum Average Power (dBm)			Reduced Average Power (dBm)		
				Measured Pwr	MPR	Tune-up Limit	Measured Pwr	MPR	Tune-up Limit
Release 99	Rel 99 (RMC, 12.2 kbps)	9262	1852.4	24.0	N/A	24.5	22.1	N/A	22.5
		9400	1880.0	24.0			22.1		
		9538	1907.6	24.1			22.2		
HSDPA	Subtest 1	9262	1852.4	24.0	0.0	24.5	22.1	0.0	22.7
		9400	1880.0	24.0			22.1		
		9538	1907.6	24.1			22.1		
	Subtest 2	9262	1852.4	23.6	0.0	24.5	22.1	0.0	22.7
		9400	1880.0	23.5			22.1		
		9538	1907.6	23.6			22.2		
	Subtest 3	9262	1852.4	22.7	0.5	24.0	22.2	0.5	22.2
		9400	1880.0	22.6			22.2		
		9538	1907.6	22.7			22.2		
	Subtest 4	9262	1852.4	22.7	0.5	24.0	22.2	0.5	22.2
		9400	1880.0	22.6			22.2		
		9538	1907.6	22.7			22.2		
HSUPA	Subtest 1	9262	1852.4	22.6	0.0	24.0	21.3	0.0	22.6
		9400	1880.0	22.6			21.3		
		9538	1907.6	22.6			21.4		
	Subtest 2	9262	1852.4	20.6	2.0	22.0	20.6	2.0	20.6
		9400	1880.0	20.6			20.6		
		9538	1907.6	20.6			20.6		
	Subtest 3	9262	1852.4	21.7	1.0	23.0	21.2	1.0	21.6
		9400	1880.0	21.6			21.2		
		9538	1907.6	21.7			21.2		
	Subtest 4	9262	1852.4	20.6	2.0	22.0	20.6	2.0	20.6
		9400	1880.0	20.6			20.6		
		9538	1907.6	20.6			20.6		
	Subtest 5	9262	1852.4	23.5	0.0	24.0	21.3	0.0	22.6
		9400	1880.0	23.5			21.3		
		9538	1907.6	23.5			21.4		
DC-HSDPA	Subtest 1	9262	1852.4	23.9	0.0	24.5	22.1	0.0	22.5
		9400	1880.0	24.1			22.1		
		9538	1907.6	24.1			22.1		
	Subtest 2	9262	1852.4	23.4	0.0	24.5	22.1	0.0	22.5
		9400	1880.0	23.6			22.1		
		9538	1907.6	23.6			22.2		
	Subtest 3	9262	1852.4	22.4	0.5	24.0	22.0	0.5	22.0
		9400	1880.0	22.6			22.0		
		9538	1907.6	22.6			22.0		
	Subtest 4	9262	1852.4	22.4	0.5	24.0	22.0	0.5	22.0
		9400	1880.0	22.6			22.0		
		9538	1907.6	22.6			22.0		

Notes:

Tune-Up Limits for WWAN (Grip Sensor), WWAN (Hotspot), and WWAN (Proxy+RCV) are the same. Power listed under Reduced Power is representative of all three Power Back-off modes.

W-CDMA Band V Measured Results

Mode		UL Ch No.	Freq. (MHz)	Maximum Average Power (dBm)		
				Measured Power	MPR	Tune-up Limit
Release 99	Rel 99 (RMC, 12.2 kbps)	4132	826.4	23.4	N/A	25.0
		4183	836.6	23.4		
		4233	846.6	23.3		
HSDPA	Subtest 1	4132	826.4	23.4	0.0	24.0
		4183	836.6	23.4		
		4233	846.6	23.3		
	Subtest 2	4132	826.4	22.7	0.0	24.0
		4183	836.6	22.7		
		4233	846.6	22.7		
	Subtest 3	4132	826.4	21.8	0.5	23.5
		4183	836.6	21.8		
		4233	846.6	21.7		
	Subtest 4	4132	826.4	21.6	0.5	23.5
		4183	836.6	21.7		
		4233	846.6	21.5		
HSUPA	Subtest 1	4132	826.4	20.5	0.0	22.0
		4183	836.6	20.6		
		4233	846.6	20.5		
	Subtest 2	4132	826.4	18.7	2.0	20.0
		4183	836.6	18.7		
		4233	846.6	18.6		
	Subtest 3	4132	826.4	19.7	1.0	21.0
		4183	836.6	19.7		
		4233	846.6	19.6		
	Subtest 4	4132	826.4	18.7	2.0	20.0
		4183	836.6	18.7		
		4233	846.6	18.6		
	Subtest 5	4132	826.4	21.7	0.0	22.0
		4183	836.6	21.7		
		4233	846.6	21.6		
DC-HSDPA	Subtest 1	4132	826.4	23.4	0.0	24.0
		4183	836.6	23.4		
		4233	846.6	23.3		
	Subtest 2	4132	826.4	22.7	0.0	24.0
		4183	836.6	22.7		
		4233	846.6	22.7		
	Subtest 3	4132	826.4	21.8	0.5	23.5
		4183	836.6	21.8		
		4233	846.6	21.7		
	Subtest 4	4132	826.4	21.6	0.5	23.5
		4183	836.6	21.7		
		4233	846.6	21.5		

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_{RB})						MPR (dB)
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2
64 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 2
64 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 3
256 QAM	≥ 1						≤ 5

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

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

Network Signalling value	Requirements (subclause)	E-UTRA Band	Channel bandwidth (MHz)	Resources Blocks (N_{RB})	A-MPR (dB)
NS_01	6.6.2.1.1	Table 5.5-1	1.4, 3, 5, 10, 15, 20	Table 5.6-1	N/A

Maximum Output Power (Tune-up Limit) for LTE

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

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

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

LTE Band 5 Measured Results

BW (MHz)	Mode	RB Allocation	RB offset	Maximum Average Power (dBm)				
					20525		MPR	Tune-up Limit
					836.5 MHz			
10 MHz	QPSK	1	0		23.4		0.0	25.0
		1	25		23.3		0.0	25.0
		1	49		23.3		0.0	25.0
		25	0		22.3		1.0	24.0
		25	12		22.3		1.0	24.0
		25	25		22.3		1.0	24.0
		50	0		22.3		1.0	24.0
	16QAM	1	0		22.2		1.0	24.0
		1	25		22.2		1.0	24.0
		1	49		22.2		1.0	24.0
		25	0		21.3		2.0	23.0
		25	12		21.3		2.0	23.0
		25	25		21.3		2.0	23.0
		50	0		21.3		2.0	23.0
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	23.3	23.3	23.3	0.0	25.0
		1	12	23.3	23.3	23.3	0.0	25.0
		1	24	23.3	23.3	23.3	0.0	25.0
		12	0	22.4	22.3	22.3	1.0	24.0
		12	7	22.4	22.3	22.3	1.0	24.0
		12	13	22.3	22.3	22.3	1.0	24.0
		25	0	22.3	22.3	22.3	1.0	24.0
	16QAM	1	0	22.2	22.2	22.2	1.0	24.0
		1	12	22.1	22.2	22.1	1.0	24.0
		1	24	22.1	22.2	22.1	1.0	24.0
		12	0	21.3	21.3	21.3	2.0	23.0
		12	7	21.3	21.3	21.3	2.0	23.0
		12	13	21.3	21.2	21.3	2.0	23.0
		25	0	21.4	21.3	21.4	2.0	23.0
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	23.4	23.4	23.4	0.0	25.0
		1	8	23.4	23.4	23.4	0.0	25.0
		1	14	23.3	23.4	23.3	0.0	25.0
		8	0	22.3	22.3	22.3	1.0	24.0
		8	4	22.2	22.3	22.3	1.0	24.0
		8	7	22.2	22.3	22.3	1.0	24.0
		15	0	22.3	22.3	22.3	1.0	24.0
	16QAM	1	0	22.3	22.4	22.4	1.0	24.0
		1	8	22.2	22.3	22.0	1.0	24.0
		1	14	22.2	22.3	22.1	1.0	24.0
		8	0	21.2	21.3	21.4	2.0	23.0
		8	4	21.2	21.3	21.4	2.0	23.0
		8	7	21.2	21.3	21.4	2.0	23.0
		15	0	21.3	21.3	21.4	2.0	23.0
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	23.4	23.4	23.4	0.0	25.0
		1	3	23.4	23.4	23.5	0.0	25.0
		1	5	23.4	23.3	23.4	0.0	25.0
		3	0	23.3	23.3	23.4	0.0	25.0
		3	1	23.3	23.3	23.4	0.0	25.0
		3	3	23.3	23.3	23.4	0.0	25.0
		6	0	22.2	22.3	22.3	1.0	24.0
	16QAM	1	0	22.2	22.2	22.2	1.0	24.0
		1	3	22.3	22.1	22.2	1.0	24.0
		1	5	22.2	22.3	22.2	1.0	24.0
		3	0	22.2	22.2	22.4	1.0	24.0
		3	1	22.2	22.2	22.4	1.0	24.0
		3	3	22.2	22.2	22.4	1.0	24.0
		6	0	21.4	21.2	21.4	2.0	23.0

9.4. Wi-Fi 2.4GHz (DTS Band)

Maximum Output Power (Tune-up Limit) for Wi-Fi 2.4 GHz

The maximum output power specified for production units are determined for all applicable 802.11 transmission modes in each standalone and aggregated frequency band. Maximum output power is measured for the highest maximum output power configuration(s) in each frequency band according to the default power measurement procedures.

For “Not required”, SAR Test reduction was applied from KDB 248227 guidance, Sec. 2.1, b), 1) when the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11b/g/n mode is used for SAR measurement, on the highest measured output power channel in the initial test configuration, for each frequency band. Additional output power measurements were not deemed necessary.

SAR testing is not required for OFDM mode(s) when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.

Wi-Fi 2.4GHz Measured Results

Band	Mode	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	2412	14.9	15.0	Yes	11.6	12.0	Yes
		6	2437	14.8	15.0		11.3	12.0	
		11	2462	15.0	15.0		11.5	12.0	
		12	2467	7.5	8.0		7.5	8.0	
		13	2472	7.8	8.0		7.8	8.0	
OFDM 2.4 GHz	802.11g	1	2412		15.0	No		12.0	No
		6	2437		15.0			12.0	
		11	2462		15.0			12.0	
		12	2467		8.0			8.0	
		13	2472		8.0			8.0	
	802.11n (HT20)	1	2412		15.0	No		12.0	No
		6	2437		15.0			12.0	
		11	2462		15.0			12.0	
		12	2467		6.0			6.0	
		13	2472		6.0			6.0	

Note(s):

SAR is not required for channel 12 and 13 because the tune-up limit and the measured output power for these two channels are not greater than those for the default test channels. Refer to KDB 248227 D01 section 3.1

9.5. Wi-Fi 5GHz (U-NII Bands)

Maximum Output Power (Tune-up Limit) for Wi-Fi 5 GHz

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 transmission mode is selected.

The maximum output power specified for production units are determined for all applicable 802.11 transmission modes in each standalone and aggregated frequency band. Maximum output power is measured for the highest maximum output power configuration(s) in each frequency band according to the default power measurement procedures.

For “Not required”, SAR Test reduction was applied from KDB 248227 guidance, Sec. 2.1, b), 1) when the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11a/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 specified maximum output power is the same for both UNII 1 and UNII 2A, begin SAR measurements in UNII 2A with the channel with the highest measured output power. If the reported SAR for UNII 2A is ≤ 1.2 W/kg, SAR is not required for UNII 1; otherwise treat the remaining bands separately and test them independently for SAR.

Wi-Fi 5 GHz Measured Results

Band	Mode	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	36	5180		15.5	No		12.0	No
		40	5200		15.5			12.0	
		44	5220		15.5			12.0	
		48	5240		15.5			12.0	
	802.11n (HT20)	36	5180	15.5	16.0	Yes		12.0	No
		40	5200	15.3	16.0			12.0	
		44	5220	15.7	16.0			12.0	
		48	5240	15.5	16.0			12.0	
	802.11ac (VHT20)	36	5180		16.0	No		12.0	No
		40	5200		16.0			12.0	
		44	5220		16.0			12.0	
		48	5240		16.0			12.0	
	802.11n (HT40)	38	5190		10.0	No		12.0	No
		46	5230		15.0			12.0	
	802.11ac (VHT40)	38	5190		10.0	No		12.0	No
		46	5230		15.0			12.0	
	802.11ac (VHT80)	42	5210		10.5	No	12.0	12.0	Yes
Band	Mode	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	52	5260		14.5	No		12.0	No
		56	5280		14.5			12.0	
		60	5300		14.5			12.0	
		64	5320		14.5			12.0	
	802.11n (HT20)	52	5260	15.6	16.0	Yes		12.0	No
		56	5280	15.5	16.0			12.0	
		60	5300	16.0	16.0			12.0	
		64	5320	15.8	16.0			12.0	
	802.11ac (VHT20)	52	5260		16.0	No		12.0	No
		56	5280		16.0			12.0	
		60	5300		16.0			12.0	
		64	5320		16.0			12.0	
	802.11n (HT40)	54	5270		15.0	No		12.0	No
		62	5310		10.5			12.0	
	802.11ac (VHT40)	54	5270		15.0	No		12.0	No
		62	5310		10.5			12.0	
	802.11ac (VHT80)	58	5290		8.0	No	12.0	12.0	Yes

Band	Mode	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	100	5500	15.8	16.0	Yes		12.0	No
		116	5580	15.4	16.0			12.0	
		124	5620	15.8	16.0			12.0	
		144	5720	15.9	16.0			12.0	
	802.11n (HT20)	100	5500		16.0	No		12.0	No
		116	5580		16.0			12.0	
		124	5620		16.0			12.0	
		144	5720		16.0			12.0	
	802.11ac (VHT20)	100	5500		16.0	No		12.0	No
		116	5580		16.0			12.0	
		124	5620		16.0			12.0	
		144	5720		16.0			12.0	
	802.11n (HT40)	102	5510		13.0	No		12.0	No
		118	5590		15.0			12.0	
		126	5630		15.0			12.0	
		142	5710		15.0			12.0	
	802.11ac (VHT40)	102	5510		13.0	No		12.0	No
		118	5590		15.0			12.0	
		126	5630		15.0			12.0	
		142	5710		15.0			12.0	
	802.11ac (VHT80)	106	5530		11.5	No	11.9	12.0	Yes
		122	5610		14.0		12.0	12.0	
		138	5690		14.0		11.6	12.0	
Band	Mode	Ch #	Freq. (MHz)	Maximum Average Power (dBm)			Reduced Average Power (dBm)		
				Meas Pwr	Tune-up	SAR Test (Yes/No)	Meas Pwr	Tune-up	SAR Test (Yes/No)
UNII-3 5.8 GHz	802.11a	149	5745	15.7	16.0	Yes		12.0	No
		157	5785	15.7	16.0			12.0	
		165	5825	15.3	16.0			12.0	
	802.11n (HT20)	149	5745		16.0	No		12.0	No
		157	5785		16.0			12.0	
		165	5825		16.0			12.0	
	802.11ac (VHT20)	149	5745		16.0	No		12.0	No
		157	5785		16.0			12.0	
		165	5825		16.0			12.0	
	802.11n (HT40)	151	5755		15.0	No		12.0	No
		159	5795		15.0			12.0	
	802.11ac (VHT40)	151	5755		15.0	No		12.0	No
		159	5795		15.0			12.0	
802.11ac (VHT80)	155	5775		14.0	No	11.7	12.0	Yes	

9.6. Bluetooth

Maximum Output Power (Tune-up Limit) for Bluetooth

From October 2016 TCB workshop, Power and SAR were measured with the device connected to a call box with hopping disabled using DH5 modulation. The duty cycle value from the device is taken from the Duty Cycle plot below.

SAR measurement is not required for the EDR and LE. When the secondary mode is $\leq 1/4$ dB higher than the primary mode.

Bluetooth Measured Results

Band	Mode	Ch #	Freq. (MHz)	Maximum Average Power (dBm)		
				Meas Pwr	Tune-up	SAR Test (Yes/No)
2.4	BR GFSK	0	2402	9.3	10.0	Yes
		39	2441	9.2	10.0	
		78	2480	9.6	10.0	
	EDR, $\pi/4$ DQPSK	0	2402	9.3	10.0	No
		39	2441	9.2	10.0	
		78	2480	9.6	10.0	
	EDR, 8-DPSK	0	2402	9.3	10.0	No
		39	2441	9.2	10.0	
		78	2480	9.6	10.0	
	LE, GFSK	0	2402	4.9	6.5	No
		19	2440	6.2	6.5	
		39	2480	5.7	6.5	

Duty Factor Measured Results

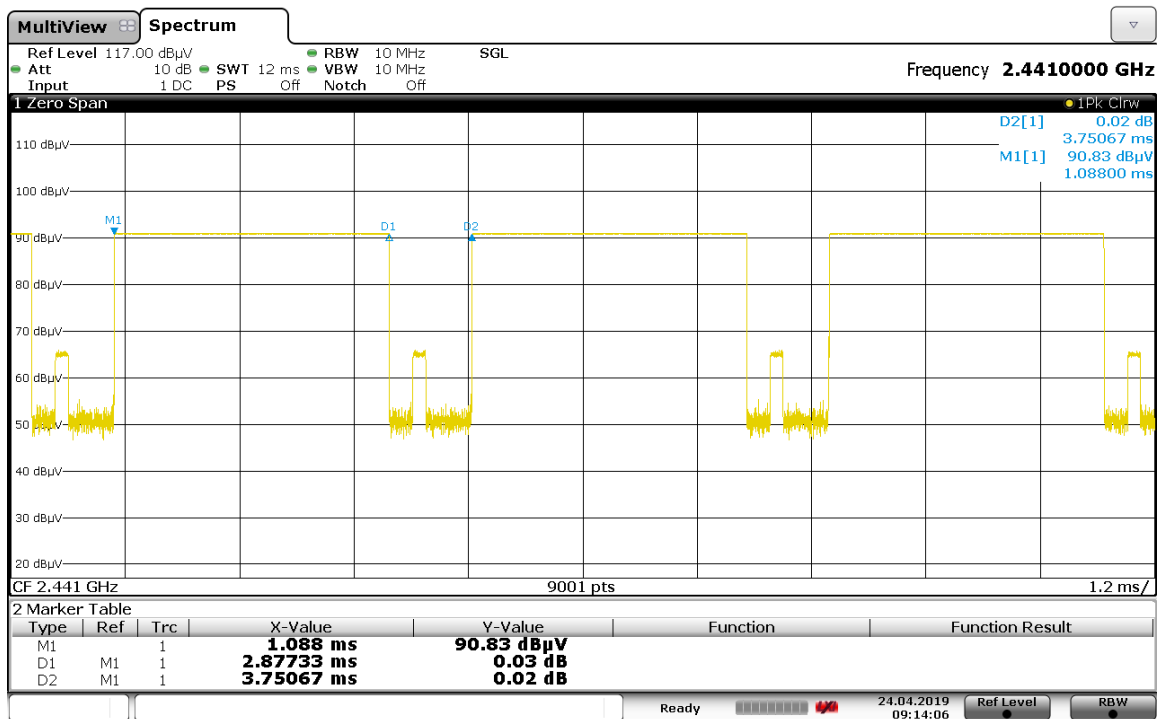
Mode	Type	T on (ms)	Period (ms)	Duty Cycle	Crest Factor (1/duty cycle)
GFSK	DH5	2.877	3.751	76.72%	1.30

Note(s):

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

Duty Cycle plots

GFSK



09:14:07 24.04.2019

10. Measured and Reported (Scaled) SAR Results

SAR Test Reduction criteria are as follows:

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

KDB 447498 D01 General RF Exposure Guidance:

Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:

- ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
- ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
- ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz

KDB 648474 D04 Handset SAR:

With headset attached, when the reported SAR for body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.

KDB 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 ≤ 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). When the reported SAR for the initial test position is:

- ≤ 0.4 W/kg, further SAR measurement is not required for the other test positions in that exposure configuration and wireless mode combination within the frequency band or aggregated band. DSSS and OFDM configurations are considered separately according to the required SAR procedures.
- > 0.4 W/kg, SAR is repeated using the same wireless mode test configuration tested in the initial test position to measure the subsequent next closet/smallest test separation distance and maximum coupling test position, on the highest maximum output power channel, until the reported SAR is ≤ 0.8 W/kg or all required test positions are tested.
 - o For subsequent test positions with equivalent test separation distance or when exposure is dominated by coupling conditions, the position for maximum coupling condition should be tested.
 - o When it is unclear, all equivalent conditions must be tested.
- For all positions/configurations tested using the initial test position and subsequent test positions, when the reported SAR is > 0.8 W/kg, measure the SAR for these positions/configurations on the subsequent next highest measured output power channel(s) until the reported SAR is ≤ 1.2 W/kg or all required test channels are considered.
 - o The additional power measurements required for this step should be limited to those necessary for identifying subsequent highest output power channels to apply the test reduction.
- When the specified maximum output power is the same for both UNII 1 and UNII 2A, begin SAR measurements in UNII 2A with the channel with the highest measured output power. If the reported SAR for UNII 2A is ≤ 1.2 W/kg, SAR is not required for UNII 1; otherwise treat the remaining bands separately and test them independently for SAR.
- When the specified maximum output power is different between UNII 1 and UNII 2A, begin SAR with the band that has the higher specified maximum output. If the highest reported SAR for the band with the highest specified power is ≤ 1.2 W/kg, testing for the band with the lower specified output power is not required; otherwise test the remaining bands independently for SAR.

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 3 Slots	N/A	0	Left Touch	190	836.6	30.0	29.0	0.345	0.434	1
				Left Tilt	190	836.6	30.0	29.0	0.110	0.138	
				Right Touch	190	836.6	30.0	29.0	0.251	0.316	
				Right Tilt	190	836.6	30.0	29.0	0.110	0.138	
Body-worn	GPRS 3 Slots	N/A	15	Rear	190	836.6	30.0	29.0	0.268	0.337	2
				Front	190	836.6	30.0	29.0	0.218	0.274	
Hotspot	GPRS 3 Slots	N/A	10	Rear	190	836.6	30.0	29.0	0.419	0.527	3
				Front	190	836.6	30.0	29.0	0.286	0.360	
				Edge 3	190	836.6	30.0	29.0	0.124	0.156	
				Edge 4	190	836.6	30.0	29.0	0.288	0.363	

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 3 Slots	ON	0	Left Touch	512	1850.2	25.5	24.0	0.618	0.873	
					661	1880.0	25.5	24.0	0.658	0.929	4
					810	1909.8	25.5	24.1	0.664	0.917	
				Left Tilt	661	1880.0	25.5	24.0	0.121	0.171	
				Right Touch	661	1880.0	25.5	24.0	0.310	0.438	
				Right Tilt	661	1880.0	25.5	24.0	0.258	0.364	
Body-worn	GPRS 3 Slots	N/A	15	Rear	661	1880.0	26.5	24.9	0.388	0.561	
				Front	661	1880.0	26.5	24.9	0.424	0.613	5
Hotspot	GPRS 3 Slots	ON	10	Rear	512	1850.2	25.0	23.3	0.569	0.842	
					661	1880.0	25.0	23.5	0.586	0.828	
					810	1909.8	25.0	23.7	0.522	0.704	
				Front	512	1850.2	25.0	23.3	0.616	0.911	6
					661	1880.0	25.0	23.5	0.579	0.818	
					810	1909.8	25.0	23.7	0.568	0.766	
				Edge 3	661	1880.0	25.0	23.5	0.160	0.226	
				Edge 4	512	1850.2	25.0	23.3	0.600	0.887	
					661	1880.0	25.0	23.5	0.627	0.886	
					810	1909.8	25.0	23.7	0.603	0.813	

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	ON	0	Left Touch	9262	1852.4	22.5	22.1	0.786	0.862	7
					9400	1880.0	22.5	22.1	0.802	0.879	
					9538	1907.6	22.5	22.2	0.767	0.822	
				Left Tilt	9400	1880.0	22.5	22.1	0.211	0.231	
				Right Touch	9400	1880.0	22.5	22.1	0.412	0.452	
				Right Tilt	9400	1880.0	22.5	22.1	0.262	0.287	
Body-worn	Rel 99 RMC 12.2 kbps	N/A	15	Rear	9400	1880.0	24.5	24.0	0.348	0.390	8
				Front	9400	1880.0	24.5	24.0	0.617	0.692	
Hotspot	Rel 99 RMC 12.2 kbps	ON	10	Rear	9262	1852.4	22.5	22.1	0.817	0.896	9
					9400	1880.0	22.5	22.1	0.741	0.812	
					9538	1907.6	22.5	22.2	0.685	0.734	
				Front	9262	1852.4	22.5	22.1	0.821	0.900	
					9400	1880.0	22.5	22.1	0.776	0.851	
					9538	1907.6	22.5	22.2	0.709	0.760	
				Edge 3	9400	1880.0	22.5	22.1	0.224	0.246	
				Edge 4	9262	1852.4	22.5	22.1	0.701	0.769	
					9400	1880.0	22.5	22.1	0.736	0.807	
					9538	1907.6	22.5	22.2	0.713	0.764	

10.4. W-CDMA Band V

RF Exposure Conditions	Mode	Power Back-off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
							Tune-up Limit	Meas.	Meas.	Scaled	
Head	Rel 99 RMC 12.2 kbps	N/A	0	Left Touch	4183	836.6	25.0	23.4	0.392	0.567	10
				Left Tilt	4183	836.6	25.0	23.4	0.155	0.224	
				Right Touch	4183	836.6	25.0	23.4	0.297	0.429	
				Right Tilt	4183	836.6	25.0	23.4	0.143	0.207	
Body-worn	Rel 99 RMC 12.2 kbps	N/A	15	Rear	4183	836.6	25.0	23.4	0.305	0.441	11
				Front	4183	836.6	25.0	23.4	0.278	0.402	
Hotspot	Rel 99 RMC 12.2 kbps	N/A	10	Rear	4183	836.6	25.0	23.4	0.488	0.705	12
				Front	4183	836.6	25.0	23.4	0.359	0.519	
				Edge 3	4183	836.6	25.0	23.4	0.165	0.238	
				Edge 4	4183	836.6	25.0	23.4	0.331	0.478	

10.5. 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	N/A	0	Left Touch	20525	836.5	1	0	25.0	23.4	0.324	0.468	13
							25	0	24.0	22.3	0.257	0.380	
				Left Tilt (15°)	20525	836.5	1	0	25.0	23.4	0.172	0.249	
							25	0	24.0	22.3	0.140	0.207	
				Right Touch	20525	836.5	1	0	25.0	23.4	0.269	0.389	
							25	0	24.0	22.3	0.208	0.308	
				Right Tilt (15°)	20525	836.5	1	0	25.0	23.4	0.158	0.228	
							25	0	24.0	22.3	0.126	0.186	
Body-worn	QPSK	N/A	15	Rear	20525	836.5	1	0	25.0	23.4	0.317	0.458	14
							25	0	24.0	22.3	0.252	0.373	
				Front	20525	836.5	1	0	25.0	23.4	0.261	0.377	
							25	0	24.0	22.3	0.209	0.309	
Hotspot	QPSK	N/A	10	Rear	20525	836.5	1	0	25.0	23.4	0.450	0.650	15
							25	0	24.0	22.3	0.359	0.531	
				Front	20525	836.5	1	0	25.0	23.4	0.306	0.442	
							25	0	24.0	22.3	0.246	0.364	
				Edge 3	20525	836.5	1	0	25.0	23.4	0.152	0.220	
							25	0	24.0	22.3	0.122	0.180	
				Edge 4	20525	836.5	1	0	25.0	23.4	0.250	0.361	
							25	0	24.0	22.3	0.195	0.288	

10.6. 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	98.67%	0.198	12.0	11.6			
				Left Tilt	1	2412	98.67%	0.147	12.0	11.6			
				Right Touch	1	2412	98.67%	0.540	12.0	11.6	0.366	0.403	16
				Right Tilt	1	2412	98.67%	0.294	12.0	11.6	0.244	0.269	
Body-worn	802.11b 1 Mbps	N/A	15	Rear	11	2462	98.67%	0.052	15.0	15.0			
				Front	11	2462	98.67%	0.102	15.0	15.0	0.065	0.066	17
Hotspot	802.11b 1 Mbps	N/A	10	Rear	11	2462	98.67%	0.105	15.0	15.0			
				Front	11	2462	98.67%	0.166	15.0	15.0	0.113	0.115	18
				Edge 1	11	2462	98.67%	0.086	15.0	15.0			
				Edge 4	11	2462	98.67%	0.094	15.0	15.0			

10.7. 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

- o ≤ 1.2 W/kg, SAR is not required for UNII band 1
- o > 1.2 W/kg, both bands should be tested independently for SAR.

RF Exposure Conditions	Mode	Power Back-off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Duty Cycle	Area Scan Max. SAR (W/kg)	Power (dBm)		1-g SAR (W/kg)		Plot No.
									Tune-up Limit	Meas.	Meas.	Scaled	
Head	802.11ac VHT80	ON	0	Left Rouch	58	5290	95.96%	0.036	12.0	12.0			
				Left Tilt	58	5290	95.96%	0.038	12.0	12.0			
				Right Touch	58	5290	95.96%	0.096	12.0	12.0	0.051	0.053	19
				Right Tilt	58	5290	95.96%	0.041	12.0	12.0			
Body-w orn	802.11n HT20	N/A	15	Rear	60	5300	91.99%	1.230	16.0	16.0	0.627	0.682	20
				Front	60	5300	91.99%	0.035	16.0	16.0	0.015	0.016	

UNII-2C

RF Exposure Conditions	Mode	Power Back-off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Duty Cycle	Area Scan Max. SAR (W/kg)	Power (dBm)		1-g SAR (W/kg)		Plot No.
									Tune-up Limit	Meas.	Meas.	Scaled	
Head	802.11ac VHT80	ON	0	Left Touch	122	5610	95.96%	0.038	12.0	12.0			
				Left Tilt	122	5610	95.96%	0.040	12.0	12.0			
				Right Touch	122	5610	95.96%	0.080	12.0	12.0	0.032	0.033	21
				Right Tilt	122	5610	95.96%	0.041	12.0	12.0			
Body-w orn	802.11a 6 Mbps	N/A	15	Rear	144	5720	92.44%	1.250	16.0	15.9	0.584	0.646	22
				Front	144	5720	92.44%	0.065	16.0	15.9	0.059	0.065	

UNII-3

RF Exposure Conditions	Mode	Power Back-off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Duty Cycle	Area Scan Max. SAR (W/kg)	Power (dBm)		1-g SAR (W/kg)		Plot No.
									Tune-up Limit	Meas.	Meas.	Scaled	
Head	802.11ac VHT80	ON	0	Left Touch	155	5775	95.96%	0.027	12.0	11.7			
				Left Tilt	155	5775	95.96%	0.027	12.0	11.7			
				Right Touch	155	5775	95.96%	0.101	12.0	11.7	0.031	0.035	23
				Right Tilt	155	5775	95.96%	0.027	12.0	11.7			
Body-w orn	802.11a 6 Mbps	N/A	15	Rear	157	5785	92.44%	1.150	16.0	15.7	0.535	0.619	24
				Front	157	5785	92.44%	0.064	16.0	15.7	0.018	0.021	
Hotspot	802.11a 6 Mbps	N/A	10	Rear	149	5745	92.44%	1.500	16.0	15.7	0.789	0.925	25
					157	5785	92.44%	1.510	16.0	15.7	0.761	0.880	
				Front	157	5785	92.44%	0.095	16.0	15.7			
				Edge 1	157	5785	92.44%	0.196	16.0	15.7			
				Edge 4	157	5785	92.44%	0.771	16.0	15.7	0.330	0.382	

10.8. Bluetooth

RF Exposure Conditions	Mode	Power Back-off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
							Tune-up Limit	Meas.	Meas.	Scaled	
Head	GFSK	N/A	0	Left Touch	78	2480	10.0	9.6	0.048	0.053	
				Left Tilt	78	2480	10.0	9.6	0.039	0.043	
				Right Touch	78	2480	10.0	9.6	0.110	0.121	26
				Right Tilt	78	2480	10.0	9.6	0.091	0.100	
Body-worn	GFSK	N/A	15	Rear	78	2480	10.0	9.6	0.006	0.006	
				Front	78	2480	10.0	9.6	0.014	0.015	27
Hotspot	GFSK	N/A	10	Rear	78	2480	10.0	9.6	0.015	0.016	
				Front	78	2480	10.0	9.6	0.023	0.025	28
				Edge 1	78	2480	10.0	9.6	0.010	0.011	
				Edge 4	78	2480	10.0	9.6	0.011	0.012	

11. SAR Measurement Variability

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

- 1) Repeated measurement is not required when the original highest measured SAR is < 0.8 or 2 W/kg (1-g or 10-g respectively); steps 2) through 4) do not apply.
- 2) When the original highest measured SAR is ≥ 0.8 or 2 W/kg (1-g or 10-g respectively), repeat that measurement once.
- 3) Perform a second repeated measurement only if the **ratio of largest to smallest SAR** for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 or 3.6 W/kg ($\sim 10\%$ from the 1-g or 10-g respective SAR limit).
- 4) Perform a third repeated measurement only if the original, first, or second repeated measurement is ≥ 1.5 or 3.75 W/kg (1-g or 10-g respectively) and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20 .

Frequency Band (MHz)	Air Interface	RF Exposure Conditions	Test Position	Repeated SAR (Yes/No)	Highest Measured SAR (W/kg)	First Repeated	
						Measured SAR (W/kg)	Largest to Smallest SAR Ratio
1900	WCDMA Band II	Hotspot	Front	Yes	0.821	0.808	1.02

Note(s):

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

12. Simultaneous Transmission Conditions

RF Exposure Condition	Item	Capable Transmit Configurations	
Head Body-w orn Hotspot	1	GSM(Voice)	+ DTS
	2	GSM(Voice)	+ U-NII
	3	GSM(Voice)	+ BT
	4	GSM(GPRS/EDGE)	+ DTS
	5	GSM(GPRS/EDGE)	+ U-NII
	6	GSM(GPRS/EDGE)	+ BT
	7	W-CDMA	+ DTS
	8	W-CDMA	+ U-NII
	9	W-CDMA	+ BT
	10	LTE	+ DTS
	11	LTE	+ U-NII
	12	LTE	+ BT
Notes:			
1. DTS & UNII (5.8GHz) supports Hotspot.			
2. GPRS/EDGE, W-CDMA, and LTE support Hotspot.			
3. DTS Radio cannot transmit simultaneously with Bluetooth Radio.			
4. U-NII Radio cannot transmit simultaneously with Bluetooth Radio.			

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.

12.1.2. SAR to Peak Location Ratio (SPLSR)

KDB 447498 D01 General RF Exposure Guidance explains how to calculate the SAR to Peak Location Ratio (SPLSR) between pairs of simultaneously transmitting antennas:

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

Where:

SAR₁ is the highest reported or estimated SAR for the first of a pair of simultaneous transmitting antennas, in a specific test operating mode and exposure condition

SAR₂ is the highest reported or estimated SAR for the second of a pair of simultaneous transmitting antennas, in the same test operating mode and exposure condition as the first

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

In order for a pair of simultaneous transmitting antennas with the sum of 1-g SAR > 1.6 W/kg to qualify for exemption from Simultaneous Transmission SAR measurements, it has to satisfy the condition of:

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

When an individual antenna transmits at on two bands simultaneously, the sum of the highest reported SAR for the frequency bands should be used to determine **SAR₁** or **SAR₂**. When SPLSR is necessary, the smallest distance between the peak SAR locations for the antenna pair with respect to the peaks from each antenna should be used.

The antennas in all antenna pairs that do not qualify for simultaneous transmission SAR test exclusion must be tested for SAR compliance, according to the enlarged zoom scan and volume scan post-processing procedures in KDB Publication 865664 D01

12.2. Sum of the SAR for GSM850 & Wi-Fi & BT

RF Exposure conditions	Test Position	Standalone SAR (W/kg)				Σ 1-g SAR (W/kg)		
		WWAN	DTS	NII	DSS	1+2	1+3	1+4
		1	2	3	4			
Head	Left Touch	0.434	0.269	0.053	0.053	0.703	0.487	0.487
	Left Tilt	0.138	0.269	0.053	0.043	0.407	0.191	0.181
	Right Touch	0.316	0.403	0.053	0.121	0.719	0.369	0.437
	Right Tilt	0.138	0.269	0.053	0.100	0.407	0.191	0.238
Body-worn	Rear	0.337	0.066	0.682	0.006	0.403	1.019	0.343
	Front	0.274	0.066	0.065	0.015	0.340	0.339	0.290
Hotspot	Rear	0.527	0.115	0.925	0.016	0.642	1.452	0.544
	Front	0.360	0.115	0.382	0.025	0.475	0.742	0.385
	Edge 1		0.115	0.382	0.011			
	Edge 2							
	Edge 3	0.156						
	Edge 4	0.363	0.115	0.382	0.012	0.478	0.744	0.375

12.3. Sum of the SAR for GSM 1900 & Wi-Fi & BT

RF Exposure conditions	Test Position	Standalone SAR (W/kg)				Σ 1-g SAR (W/kg)		
		WWAN	DTS	NII	DSS	1+2	1+3	1+4
		1	2	3	4			
Head	Left Touch	0.929	0.269	0.053	0.053	1.198	0.982	0.982
	Left Tilt	0.171	0.269	0.053	0.043	0.440	0.224	0.214
	Right Touch	0.438	0.403	0.053	0.121	0.841	0.491	0.558
	Right Tilt	0.364	0.269	0.053	0.100	0.633	0.417	0.464
Body-worn	Rear	0.561	0.066	0.682	0.006	0.627	1.243	0.567
	Front	0.613	0.066	0.065	0.015	0.679	0.678	0.628
Hotspot	Rear	0.842	0.115	0.925	0.016	0.957	1.767	0.858
	Front	0.911	0.115	0.382	0.025	1.026	1.293	0.936
	Edge 1		0.115	0.382	0.011			
	Edge 2							
	Edge 3	0.226						
	Edge 4	0.887	0.115	0.382	0.012	1.002	1.269	0.900

SAR to Peak Location Separation Ratio (SPLSR)

Test Position	Standalone SAR (W/kg)		Σ 1-g SAR (W/kg)		Calculated distance (mm)	SPLSR (≤ 0.04)	Volume Scan (Yes/ No)
	1	3					
	WWAN	Wi-Fi 5G					
Rear	0.842	0.925	1+3	1.767	99.0	0.02	No
Mode		Peak SAR	X	Y	Z	d: Calculated distance (mm)	
		W/kg	m	m	m		
WWAN	1	0.796	0.0255	-0.05	-0.181	1+3	99.0
U-NII	3	1.99	0.028	0.049	-0.18		

12.4. Sum of the SAR for W-CDMA Band II & Wi-Fi & BT

RF Exposure conditions	Test Position	Standalone SAR (W/kg)				Σ 1-g SAR (W/kg)		
		WWAN	DTS	NII	DSS	1+2	1+3	1+4
		1	2	3	4			
Head	Left Touch	0.879	0.269	0.053	0.053	1.148	0.932	0.932
	Left Tilt	0.231	0.269	0.053	0.043	0.500	0.284	0.274
	Right Touch	0.452	0.403	0.053	0.121	0.855	0.505	0.572
	Right Tilt	0.287	0.269	0.053	0.100	0.556	0.340	0.387
Body-worn	Rear	0.390	0.066	0.682	0.006	0.456	1.072	0.397
	Front	0.692	0.066	0.065	0.015	0.758	0.757	0.708
Hotspot	Rear	0.896	0.115	0.925	0.016	1.011	1.821	0.912
	Front	0.900	0.115	0.382	0.025	1.015	1.282	0.925
	Edge 1		0.115	0.382	0.011			
	Edge 2							
	Edge 3	0.246						
	Edge 4	0.807	0.115	0.382	0.012	0.922	1.189	0.819

SAR to Peak Location Separation Ratio (SPLSR)

Test Position	Standalone SAR (W/kg)		Σ 1-g SAR (W/kg)		Calculated distance (mm)	SPLSR (≤ 0.04)	Volume Scan (Yes/ No)
	1	3					
	WWAN	Wi-Fi 5G					
Rear	0.896	0.925	1+3	1.821	92.0	0.03	No
Mode		Peak SAR	X	Y	Z	d: Calculated distance (mm)	
		W/kg	m	m	m		
WWAN	1	1.12	0.0295	-0.043	-0.178	1+3	92.0
U-NII	3	1.99	0.028	0.049	-0.18		

12.5. Sum of the SAR for W-CDMA Band V & Wi-Fi & BT

RF Exposure conditions	Test Position	Standalone SAR (W/kg)				Σ 1-g SAR (W/kg)		
		WWAN	DTS	NII	DSS	1+2	1+3	1+4
		1	2	3	4			
Head	Left Touch	0.567	0.269	0.053	0.053	0.835	0.620	0.619
	Left Tilt	0.224	0.269	0.053	0.043	0.493	0.277	0.267
	Right Touch	0.429	0.403	0.053	0.121	0.832	0.482	0.550
	Right Tilt	0.207	0.269	0.053	0.100	0.475	0.260	0.306
Body-worn	Rear	0.441	0.066	0.682	0.006	0.507	1.123	0.447
	Front	0.402	0.066	0.065	0.015	0.468	0.467	0.417
Hotspot	Rear	0.705	0.115	0.925	0.016	0.820	1.630	0.722
	Front	0.519	0.115	0.382	0.025	0.634	0.901	0.544
	Edge 1		0.115	0.382	0.011			
	Edge 2							
	Edge 3	0.238						
	Edge 4	0.478	0.115	0.382	0.012	0.593	0.860	0.491

SAR to Peak Location Separation Ratio (SPLSR)

Test Position	Standalone SAR (W/kg)		Σ 1-g SAR (W/kg)		Calculated distance (mm)	SPLSR (≤ 0.04)	Volume Scan (Yes/ No)
	1	3					
	WWAN	Wi-Fi 5G					
Rear	0.705	0.925	1+3	1.630	109.5	0.02	No
Mode		Peak SAR	X	Y	Z	d: Calculated distance (mm)	
		W/kg	m	m	m		
WWAN	1	0.703	0.018	-0.06	-0.18	1+3	109.5
U-NII	3	1.99	0.028	0.049	-0.18		

12.6. Sum of the SAR for LTE Band 5 & Wi-Fi & BT

RF Exposure conditions	Test Position	Standalone SAR (W/kg)				Σ 1-g SAR (W/kg)		
		WWAN	DTS	NII	DSS	1+2	1+3	1+4
		1	2	3	4			
Head	Left Touch	0.468	0.269	0.053	0.053	0.737	0.521	0.521
	Left Tilt	0.249	0.269	0.053	0.043	0.517	0.302	0.291
	Right Touch	0.389	0.403	0.053	0.121	0.792	0.442	0.509
	Right Tilt	0.228	0.269	0.053	0.100	0.497	0.281	0.328
Body-worn	Rear	0.458	0.066	0.682	0.006	0.524	1.140	0.465
	Front	0.377	0.066	0.065	0.015	0.443	0.442	0.393
Hotspot	Rear	0.650	0.115	0.925	0.016	0.765	1.575	0.667
	Front	0.442	0.115	0.382	0.025	0.557	0.824	0.468
	Edge 1		0.115	0.382	0.011			
	Edge 2							
	Edge 3	0.220						
	Edge 4	0.361	0.115	0.382	0.012	0.476	0.743	0.373

Conclusion:

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

Appendixes

Refer to separated files for the following appendixes.

Appendix A: SAR Setup Photos

Appendix B: SAR System Check Plots

Appendix C: SAR Highest Test Plots

Appendix D: SAR Tissue Ingredients

Appendix E: SAR Probe Certificates

Appendix F: SAR Dipole Certificates

END OF REPORT