SAR EVALUATION REPORT

FCC 47 CFR § 2.1093
IEEE Std 1528-2013

For
GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n and NFC

FCC ID: A3LSMG390F
Model Name: SM-G390F

Report Number: 4787833362-S1V2
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ACCREDITED

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Revision History

Rev.	Date	Revisions	Revised By
V1	2/22/2017	Initial Issue	Sunghoon Kim
V2	2/27/2017	Added information in Sec.10.	Sunghoon Kim

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 10

6. Device Under Test (DUT) Information 11

6.1. DUT Description 11

6.1. Wireless Technologies 12

6.3. Nominal and Maximum Output Power 13

6.4. General LTE SAR Test and Reporting Considerations 14

6.5. Power Reduction by Proximity Sensing 15

6.5.1. Proximity Sensor Triggering Distance (KDB 616217 §6.2) 15

6.5.2. Resulting test positions for SAR measurements 16

7. RF Exposure Conditions (Test Configurations) 17

8. Dielectric Property Measurements & System Check 18

8.1. Dielectric Property Measurements 18

8.2. System Check 21

9. Conducted Output Power Measurements 23

9.1. GSM 23

9.2. W-CDMA 25

9.3. LTE 29

9.4. Wi-Fi 2.4GHz (DTS Band) 32

9.5. Wi-Fi 5GHz (U-NII Bands) 33

9.6. Bluetooth 33

10. Measured and Reported (Scaled) SAR Results 34

10.1. GSM850 36

10.2. GSM1900 36

10.3. W-CDMA Band II 37

10.4. W-CDMA Band V 37

10.5. LTE Band 5 (10MHz Bandwidth) 37

10.6. Wi-Fi (DTS Band) *38*
10.7. Wi-Fi (U-NII Band) *38*
10.8. Bluetooth *39*

11. SAR Measurement Variability **40**

12. Simultaneous Transmission SAR Analysis **41**
12.1. Sum of the SAR for WWAN & Wi-Fi & BT *42*

Appendixes **43**
4787833362-S1V2 FCC Report SAR_App A_Photos & Ant. Locations *43*
4787833362-S1V2 FCC Report SAR_App B_Highest SAR Test Plots *43*
4787833362-S1V2 FCC Report SAR_App C_System Check Plots *43*
4787833362-S1V2 FCC Report SAR_App D_SAR Tissue Ingredients *43*
4787833362-S1V2 FCC Report SAR_App E_Probe Cal. Certificates *43*
4787833362-S1V2 FCC Report SAR_App F_Dipole Cal. Certificates *43*

1. Attestation of Test Results

Applicant Name		SAMSUNG ELECTRONICS CO.,LTD.			
FCC ID		A3LSMG390F			
Model Name		SM-G390F			
Applicable Standards		FCC 47 CFR § 2.1093 Published RF exposure KDB procedures IEEE Std 1528-2013			
SAR Limits (W/Kg)					
Exposure Category		Peak spatial-average(1g of tissue)			
General population / Uncontrolled exposure		1.6			
The Highest Reported SAR (W/kg)					
RF Exposure Conditions		**Equipment Class**			
		Licensed	**DTS**	**U-NII**	**DSS (BT)**
Head		0.507	0.105	0.025	N/A
Body-worn		0.627	0.028	0.151	
Hotspot/Wi-Fi Direct		0.750	0.060	0.213	
Simultaneous TX	Head	0.612		0.532	
	Body-worn	0.778	0.655	0.778	
	Hotspot	0.810		N/A	
Date Tested		1/16/2017 to 2/10/2017			
Test Results		Pass			

UL Korea, Ltd. 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 Korea, Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Korea, Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Korea, Ltd. 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 IAS, any agency of the Federal Government, or any agency of any government.

Approved & Released By:	Prepared By:
	
Justin Park Senior Engineer UL Korea, Ltd. Suwon Laboratory	Sunghoon Kim Laboratory Engineer UL Korea, Ltd. Suwon Laboratory

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
- 648474 D04 Handset SAR v01r03
- 690783 D01 SAR Listings on Grants 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 D06 Hotspot Mode v02r01

3. Facilities and Accreditation

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

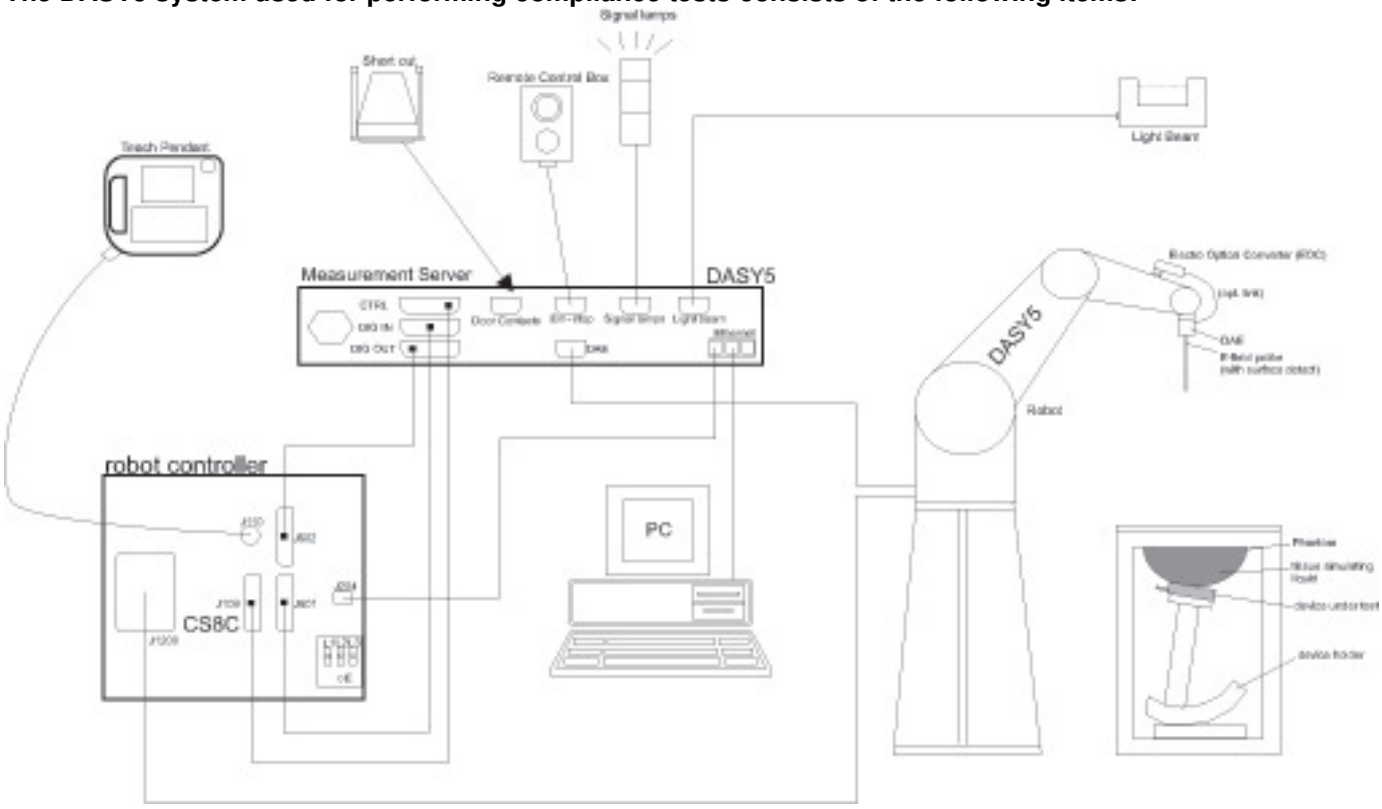
Suwon
SAR 1 Room
SAR 2 Room
SAR 3 Room

UL Korea, Ltd. is accredited by IAS, Laboratory Code TL-637.
The full scope of accreditation can be viewed at http://www.iasonline.org/PDF/TL/TL-637.pdf.

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	½·δ·ln(2) ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{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 ≤ 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: Δx_{Zoom}, Δy_{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: $\Delta z_{Zoom}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	≤ 1.5·$\Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 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 *reported* SAR from the area scan based *1-g SAR estimation* procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.

Step 4: Power drift measurement

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

Step 5: Z-Scan (FCC only)

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

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
Network Analyzer	Agilent	E5071C	MY46522054	8-18-2017
Dielectric Assessment Kit	SPEAG	DAK-3.5	1196	7-26-2017
Shorting block	SPEAG	DAK-3.5 Short	SM DAK 200 BA	N/A
Thermometer	LKM	DTM3000	3424	8-17-2017
Thermometer	Lutron	MHB-382SD	AH.91478	8-10-2017

System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
MXG Analog Signal Generator	Agilent	N5181A	MY50145882	8-16-2017
Power Sensor	Agilent	U2000A	MY54260010	8-17-2017
Power Sensor	Agilent	U2000A	MY54260007	8-17-2017
Power Amplifier	EXODUS	1410025-AMP2027-10003	10003	8-17-2017
Directional Coupler	Agilent	772D	MY52180193	8-17-2017
Directional Coupler	Agilent	778D	MY52180432	8-17-2017
Low Pass Filter	MICROLAB	LA-15N	03943	8-17-2017
Low Pass Filter	FILTRON	L14012FL	1410003S	8-17-2017
Low Pass Filter	MICROLAB	LA-60N	03942	8-17-2017
Attenuator	Agilent	8491B/003	MY39269292	8-17-2017
Attenuator	Agilent	8491B/010	MY39269315	8-17-2017
Attenuator	Agilent	8491B/020	MY39269298	8-17-2017
E-Field Probe (SAR1)	SPEAG	EX3DV4	7376	8-30-2017
E-Field Probe (SAR2)	SPEAG	EX3DV4	7330	2-24-2017
E-Field Probe (SAR3)	SPEAG	EX3DV4	7314	9-27-2017
Data Acquisition Electronics (SAR1)	SPEAG	DAE4	1447	9-19-2017
Data Acquisition Electronics (SAR2)	SPEAG	DAE4	1468	9-8-2017
Data Acquisition Electronics (SAR3)	SPEAG	DAE4	1494	7-18-2017
System Validation Dipole	SPEAG	D835V2	4d194	7-20-2017
System Validation Dipole	SPEAG	D1900V2	5d199	2-19-2017
System Validation Dipole	SPEAG	D2450V2	939	9-23-2017
System Validation Dipole	SPEAG	D5GHzV2	1184	9-1-2017
Thermometer (SAR1)	Lutron	MHB-382SD	AH.91463	8-10-2017
Thermometer (SAR2)	Lutron	MHB-382SD	AH.50215	8-17-2017
Thermometer (SAR3)	Lutron	MHB-382SD	AH.50213	8-17-2017

Other

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Base Station Simulator	R & S	CMW500	150313	8-16-2017
Base Station Simulator	R & S	CMW500	150314	8-16-2017

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, the 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	Overall (Length x Width): 144 mm x 71 mm Overall Diagonal: 152 mm Display Diagonal: 127 mm		
Back Cover	☒ Normal Battery Cover with NFC		
Battery Options	☒ Standard – Lithium-ion battery, Rating 3.85V, 10.78Wh		
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)		
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 GHz, Only Ch.149)		
Test sample information	**No.**	**S/N**	**Notes**
	1	R38HC02391M	Main Conduction
	2	R38HC0238EX	Main Conduction
	3	420044acecf4b3cd	Wi-Fi Conduction
	4	420044acec93b391	Wi-Fi Conduction
	5	R38HC0238EX	SAR
	6	R38HC02382L	SAR
	7	R38J10B58MB	SAR

6.1. Wireless Technologies

Wireless technologies	Frequency bands	Operating mode		Duty Cycle used for SAR testing
GSM	850 1900	Voice (GMSK) GPRS (GMSK) EGPRS (8PSK)	GPRS Multi-Slot Class: ☐ Class 8 - 1 Up, 4 Down ☐ Class 10 - 2 Up, 4 Down ☐ Class 12 - 4 Up, 4 Down ☒ 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 (Release.5) HSUPA (Release.6) HSPA+ (Release.7)		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)		100%
	5 GHz	802.11a 802.11n (HT20) 802.11n (HT40)		100%
	Does this device support bands 5.60 ~ 5.65 GHz? ☒ Yes ☐ No			
	Does this device support Band gap channel? ☒ Yes ☐ No			
Bluetooth	2.4 GHz	Version 4.2 LE		76.85%

6.3. Nominal and Maximum Output Power

KDB 447498 sec.4.1.(3) at the maximum rated output power and within the tune-up tolerance range specified for the product, but not more than 2 dB lower than the maximum tune-up tolerance limit

Upper limit (dB): -1.5 ~ 0.5		Max. RF Output Power (dBm)		Reduction. RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit	Target	Max. tune-up tolerance limit
GSM850	Voice (1 slot)	32.0	**32.5**	N/A	
	GPRS 1 slot	32.0	**32.5**		
	GPRS 2 slots	31.0	**31.5**		
	GPRS 3 slots	29.5	**30.0**		
	GPRS 4 slots	28.5	**29.0**		
	EGPRS 1 slot	27.0	**27.5**		
	EGPRS 2 slots	25.0	**25.5**		
	EGPRS 3 slots	24.0	**24.5**		
	EGPRS 4 slots	22.5	**23.0**		
GSM1900	Voice (1 slot)	28.5	**29.0**		
	GPRS 1 slot	28.5	**29.0**		
	GPRS 2 slots	27.0	**27.5**		
	GPRS 3 slots	25.0	**25.5**		
	GPRS 4 slots	24.0	**24.5**		
	EGPRS 1 slot	25.0	**25.5**		
	EGPRS 2 slots	23.0	**23.5**		
	EGPRS 3 slots	22.0	**22.5**		
	EGPRS 4 slots	21.0	**21.5**		
W-CDMA Band V	R99	23.0	**23.5**	N/A	
	HSDPA	22.0	**22.5**		
	HSUPA	21.5	**22.0**		
W-CDMA Band II	R99	22.0	**22.5**	20.0	**20.5**
	HSDPA	21.5	**22.0**	20.0	**20.5**
	HSUPA	21.5	**22.0**	20.0	**20.5**
LTE Band 5	QPSK, 16QAM	23.0	**23.5**	N/A	

Note(s):

The device utilizes power reduction under some portable hotspot conditions for SAR compliance. There is power reduction for WCDMA Band II. The reduced powers were confirmed via conducted power measurements the RF port. Detailed description of the hotspot power reduction mechanism is included in the operational description.

Upper limit (dB): ~ 0.5		Max. RF Output Power (dBm)		Reduction. RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit	Target	Max. tune-up tolerance limit
WiFi 2.4 GHz	802.11b (Ch.1 - Ch.11)	17.0	**17.5**	14.0	**14.5**
	802.11b (Ch.12 & Ch.13)	7.0	**7.5**	N/A	
	802.11g (Ch.1 - Ch.11	13.0	**13.5**	N/A	
	802.11g (Ch.12 & Ch.13)	7.0	**7.5**	N/A	
	802.11n HT20 (Ch.1 - Ch.11)	13.0	**13.5**	N/A	
	802.11n HT20 (Ch.12 & Ch.13)	5.0	**5.5**	N/A	
WiFi 5 GHz	802.11a	13.0	**13.5**	N/A	
	802.11n HT20	13.0	**13.5**		
	802.11n HT40	12.5	**13.0**		
Bluetooth		8.5	**9.0**	N/A	
Bluetooth LE		6.5	**7.0**		

Note(s):

This device uses an independent fixed level power reduction mechanism for WiFi 2.4GHz (802.11b) operations during voice or VoIP held to ear scenarios. Per FCC Guidance, the held-to-ear exposure conditions were evaluated at reduced power according to the head SAR positions described in IEEE 1528-2013. Detailed description of the power reduction mechanism are included in the operational description.

6.4. General LTE SAR Test and Reporting Considerations

<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>Frequency range, Channel Bandwidth, Numbers and Frequencies</td><td>
<table>
<tr><td rowspan="3">Band 5</td><td colspan="6">Frequency range: 824 - 849 MHz</td></tr>
<tr><td colspan="6">Channel Bandwidth</td></tr>
<tr><td>20 MHz</td><td>15 MHz</td><td>10 MHz</td><td>5 MHz</td><td>3 MHz</td><td>1.4 MHz</td></tr>
<tr><td>Low</td><td></td><td></td><td>20450/ 829</td><td>20425/ 826.5</td><td>20415/ 825.5</td><td>20407/ 824.7</td></tr>
<tr><td>Mid</td><td></td><td></td><td>20525/ 836.5</td><td>20525/ 836.5</td><td>20525/ 836.5</td><td>20525/ 836.5</td></tr>
<tr><td>High</td><td></td><td></td><td>20600/ 844</td><td>20625/ 846.5</td><td>20635/ 847.5</td><td>20643/ 848.3</td></tr>
</table>
</td></tr>
<tr><td>LTE transmitter and antenna implementation</td><td>LTE has 1 Main TX/RX Ant and 1 Diversity RX Ant Refer to Appendix A...</td></tr>
<tr><td>Maximum power reduction (MPR)</td><td>
Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3
<table>
<tr><th rowspan="2">Modulation</th><th colspan="6">Channel bandwidth / Transmission bandwidth (RB)</th><th rowspan="2">MPR (dB)</th></tr>
<tr><th>1.4 MHz</th><th>3.0 MHz</th><th>5 MHz</th><th>10 MHz</th><th>15 MHz</th><th>20 MHz</th></tr>
<tr><td>QPSK</td><td>> 5</td><td>> 4</td><td>> 8</td><td>> 12</td><td>> 16</td><td>> 18</td><td>≤ 1</td></tr>
<tr><td>16 QAM</td><td>≤ 5</td><td>≤ 4</td><td>≤ 8</td><td>≤ 12</td><td>≤ 16</td><td>≤ 18</td><td>≤ 1</td></tr>
<tr><td>16 QAM</td><td>> 5</td><td>> 4</td><td>> 8</td><td>> 12</td><td>> 16</td><td>> 18</td><td>≤ 2</td></tr>
</table>
MPR Built-in by design
A-MPR (additional MPR) was disabled during SAR testing
</td></tr>
<tr><td>Power reduction</td><td>No</td></tr>
<tr><td>Spectrum plots for RB configurations</td><td>A properly configured base station simulator was used for the SAR and power measurements; therefore, spectrum plots for each RB allocation and offset configuration are not included in the SAR report.</td></tr>
</table>

6.5. Power Reduction by Proximity Sensing

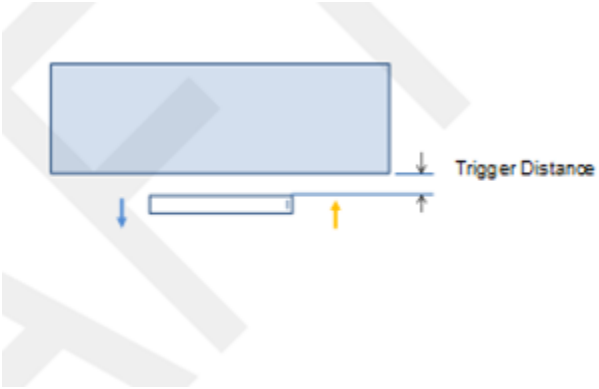
6.5.1. Proximity Sensor Triggering Distance (KDB 616217 §6.2)

Front of the DUT was placed directly below the flat phantom. The DUT was moved toward the phantom in accordance with the steps outlined in KDB 616217 §6.2 to determine the trigger distance for enabling power reduction. The DUT was moved away from the phantom to determine the trigger distance for resuming full power.

The measurement was then repeated for the surface of Front

The DUT featured a visual indicator on its display that showed the status of the proximity sensor (Triggered or not triggered). This was used to determine the status of the sensor during the proximity sensor assessment as monitoring the output power directly was not practical without affecting the measurement.

It was confirmed separately that the output power was altered according to the proximity sensor status indication. This was achieved by observing the proximity sensor status at the same time as monitoring the conducted power. Section 9 contains both the full and reduced conducted power measurements.



Proximity Sensor Trigger Distance Assessment
KDB 616217 §6.2, Front

LEGEND

Direction of DUT travel for determination of power reduction triggering point

Direction of DUT travel for determination of full power resumption triggering point

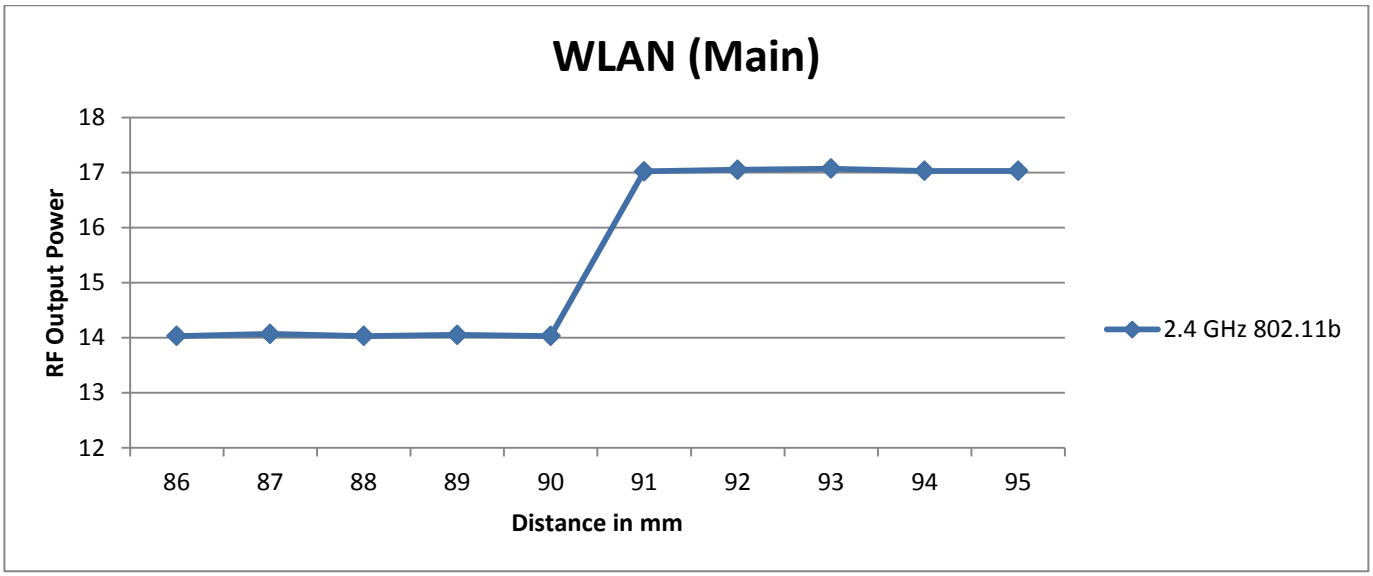
Summary of Trigger Distances

Tissue simulating liquid	Trigger distance - Front	
	Moving toward phantom	Moving from phantom
2450 Head	90 mm	90 mm

Wi-Fi 2.4GHz

Front, DUT Moving Toward (Trigger) and Away (Release) from the Phantom

Distance to DUT vs. Output Power in dBm											
Antenna	Distance	86	87	88	89	90	91	92	93	94	95
Main	2.4 GHz 802.11b	14.0	14.1	14.0	14.1	14.0	17.0	17.1	17.1	17.0	17.0



6.5.2. Resulting test positions for SAR measurements

Wireless technologies	DUT Position	§6.2 Triggering Distance	§6.3 Coverage	§6.4 Tilt Angle	Worst case distance for SAR
WLAN	Front	90 mm	N/A	N/A	89 mm

Notes:

Worst case distance for SAR is not consider for body exposure condition. Because Power reduction is only apply voice or VoIP held to ear scenarios.

7. RF Exposure Conditions (Test Configurations)

Refer to “SAR Photos and Ant locations” Appendix 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 / Wi-Fi Direct	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:

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

8. Dielectric Property Measurements & System Check

8.1. Dielectric Property Measurements

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

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 1 Room

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
1-16-2017	Body 835	e'	54.5700	Relative Permittivity (ϵ_r):	54.57	55.20	-1.14	5
		e"	20.7200	Conductivity (σ):	0.96	0.97	-0.82	5
	Body 820	e'	54.7100	Relative Permittivity (ϵ_r):	54.71	55.28	-1.03	5
		e"	20.7800	Conductivity (σ):	0.95	0.97	-2.17	5
	Body 850	e'	54.4300	Relative Permittivity (ϵ_r):	54.43	55.16	-1.32	5
		e"	20.6500	Conductivity (σ):	0.98	0.99	-1.13	5
1-19-2017	Body 1900	e'	53.7800	Relative Permittivity (ϵ_r):	53.78	53.30	0.90	5
		e"	14.3700	Conductivity (σ):	1.52	1.52	-0.12	5
	Body 1850	e'	53.9200	Relative Permittivity (ϵ_r):	53.92	53.30	1.16	5
		e"	14.1500	Conductivity (σ):	1.46	1.52	-4.24	5
	Body 1910	e'	53.7400	Relative Permittivity (ϵ_r):	53.74	53.30	0.83	5
		e"	14.4200	Conductivity (σ):	1.53	1.52	0.75	5
2-6-2017	Body 2450	e'	51.8800	Relative Permittivity (ϵ_r):	51.88	52.70	-1.56	5
		e"	14.7100	Conductivity (σ):	2.00	1.95	2.76	5
	Body 2410	e'	51.9800	Relative Permittivity (ϵ_r):	51.98	52.76	-1.48	5
		e"	14.6300	Conductivity (σ):	1.96	1.91	2.78	5
	Body 2475	e'	51.8200	Relative Permittivity (ϵ_r):	51.82	52.67	-1.61	5
		e"	14.7700	Conductivity (σ):	2.03	1.99	2.39	5
2-9-2017	Head 2450	e'	38.7500	Relative Permittivity (ϵ_r):	38.75	39.20	-1.15	5
		e"	13.3100	Conductivity (σ):	1.81	1.80	0.73	5
	Head 2410	e'	38.8600	Relative Permittivity (ϵ_r):	38.86	39.28	-1.07	5
		e"	13.2200	Conductivity (σ):	1.77	1.76	0.63	5
	Head 2475	e'	38.6700	Relative Permittivity (ϵ_r):	38.67	39.17	-1.27	5
		e"	13.3800	Conductivity (σ):	1.84	1.83	0.78	5
2-10-2017	Head 5180	e'	35.9300	Relative Permittivity (ϵ_r):	35.93	36.01	-0.23	10
		e"	15.7600	Conductivity (σ):	4.54	4.63	-1.97	5
	Head 5200	e'	35.9500	Relative Permittivity (ϵ_r):	35.95	35.99	-0.11	10
		e"	15.8000	Conductivity (σ):	4.57	4.65	-1.78	5
	Head 5600	e'	35.4600	Relative Permittivity (ϵ_r):	35.46	35.53	-0.21	10
		e"	16.0600	Conductivity (σ):	5.00	5.06	-1.18	5
	Head 5800	e'	35.2100	Relative Permittivity (ϵ_r):	35.21	35.30	-0.25	10
		e"	16.1600	Conductivity (σ):	5.21	5.27	-1.11	5
	Head 5825	e'	35.1800	Relative Permittivity (ϵ_r):	35.18	35.30	-0.34	10
		e"	16.1900	Conductivity (σ):	5.24	5.27	-0.50	5

SAR 2 Room

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
1-18-2017	Head 835	e'	41.0200	Relative Permittivity (ε_r):	41.02	41.50	-1.16	5
		e"	19.3900	Conductivity (σ):	0.90	0.90	0.03	5
	Head 820	e'	41.2000	Relative Permittivity (ε_r):	41.20	41.60	-0.97	5
		e"	19.4600	Conductivity (σ):	0.89	0.90	-1.25	5
	Head 850	e'	40.8700	Relative Permittivity (ε_r):	40.87	41.50	-1.52	5
		e"	19.3300	Conductivity (σ):	0.91	0.92	-0.15	5

SAR 3 Room

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
1-21-2017	Head 1900	e'	40.0500	Relative Permittivity (ε_r):	40.05	40.00	0.12	5
		e"	13.3500	Conductivity (σ):	1.41	1.40	0.74	5
	Head 1850	e'	40.2000	Relative Permittivity (ε_r):	40.20	40.00	0.50	5
		e"	13.2300	Conductivity (σ):	1.36	1.40	-2.79	5
	Head 1910	e'	40.0200	Relative Permittivity (ε_r):	40.02	40.00	0.05	5
		e"	13.3800	Conductivity (σ):	1.42	1.40	1.50	5
2-11-2017	Body 5180	e'	48.2800	Relative Permittivity (ε_r):	48.28	49.05	-1.56	10
		e"	18.1400	Conductivity (σ):	5.22	5.27	-0.88	5
	Body 5300	e'	48.0800	Relative Permittivity (ε_r):	48.08	48.88	-1.64	10
		e"	18.2600	Conductivity (σ):	5.38	5.41	-0.56	5
	Body 5600	e'	47.6100	Relative Permittivity (ε_r):	47.61	48.48	-1.79	10
		e"	18.5700	Conductivity (σ):	5.78	5.76	0.37	5
	Body 5800	e'	47.3000	Relative Permittivity (ε_r):	47.30	48.20	-1.87	10
		e"	18.7900	Conductivity (σ):	6.06	6.00	1.00	5
	Body 5825	e'	47.2500	Relative Permittivity (ε_r):	47.25	48.20	-1.97	10
		e"	18.8300	Conductivity (σ):	6.10	6.00	1.65	5

8.2. System Check

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

System Performance Check Measurement Conditions:

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

Reference Target SAR Values

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

System Dipole	Serial No.	Cal. Date	Freq. (MHz)	Target SAR Values (W/kg)		
				1g/10g	Head	Body
D835V2	4d194	7-20-2016	835	1g	9.52	9.65
				10g	6.22	6.28
D1900V2	5d199	2-19-2016	1900	1g	39.80	39.50
				10g	20.70	20.90
D2450V2	939	9-23-2016	2450	1g	52.10	49.90
				10g	24.40	23.70
D5GHzV2	1184	9-1-2016	5300	1g	82.20	75.90
				10g	23.50	21.40
D5GHzV2	1184	9-1-2016	5600	1g	81.80	78.10
				10g	23.30	21.90
D5GHzV2	1184	9-1-2016	5800	1g	78.30	75.60
				10g	22.30	21.00

System Check Results

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

SAR 1 Room

Date Tested	System Dipole		T.S. Liquid		Measured Results		Target (Ref. Value)	Delta ±10 %	Plot No.
	Type	Serial #			Zoom Scan to 100 mW	Normalize to 1 W			
1-16-2017	D835V2	4d194	Body	1g	0.98	9.81	9.65	1.66	
				10g	0.65	6.45	6.28	2.71	
1-19-2017	D1900V2	5d199	Body	1g	4.22	42.20	39.50	6.84	1, 2
				10g	2.18	21.80	20.90	4.31	
2-6-2017	D2450V2	939	Body	1g	5.06	50.60	49.90	1.40	3, 4
				10g	2.30	23.00	23.70	-2.95	
2-9-2017	D2450V2	939	Head	1g	5.16	51.60	52.10	-0.96	
				10g	2.35	23.50	24.40	-3.69	
2-10-2017	D5GHzV2 (5300)	1184	Head	1g	8.17	81.70	82.20	-0.61	
				10g	2.32	23.20	23.50	-1.28	
2-10-2017	D5GHzV2 (5600)	1184	Head	1g	8.41	84.10	81.80	2.81	
				10g	2.39	23.90	23.30	2.58	
2-10-2017	D5GHzV2 (5800)	1184	Head	1g	8.19	81.90	78.30	4.60	
				10g	2.33	23.30	22.30	4.48	

SAR 2 Room

Date Tested	System Dipole		T.S. Liquid		Measured Results		Target (Ref. Value)	Delta ±10 %	Plot No.
	Type	Serial #			Zoom Scan to 100 mW	Normalize to 1 W			
1-18-2017	D835V2	4d194	Head	1g	1.02	10.20	9.52	7.14	5, 6
				10g	0.67	6.65	6.22	6.91	

SAR 2 Room

Date Tested	System Dipole		T.S. Liquid		Measured Results		Target (Ref. Value)	Delta ±10 %	Plot No.
	Type	Serial #			Zoom Scan to 100 mW	Normalize to 1 W			
1-21-2017	D1900V2	5d199	Head	1g	4.00	40.00	39.80	0.50	
				10g	2.03	20.30	20.70	-1.93	
2-11-2017	D5GHzV2 (5300)	1184	Body	1g	7.45	74.50	75.90	-1.84	
				10g	2.06	20.60	21.40	-3.74	
2-11-2017	D5GHzV2 (5600)	1184	Body	1g	8.24	82.40	78.10	5.51	7, 8
				10g	2.28	22.80	21.90	4.11	
2-11-2017	D5GHzV2 (5800)	1184	Body	1g	7.21	72.10	75.60	-4.63	
				10g	1.98	19.80	21.00	-5.71	

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.

GSM850 Measured Results

Band	Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Max. Pwr		Frame Pwr Maximum
						Burst (dBm)	Frame (dBm)	
850	GSM (Voice)	CS1	1	128	824.2	31.3	22.3	23.5
				190	836.6	31.5	22.5	
				251	848.8	31.6	22.6	
	GPRS (GMSK)	CS1	1	128	824.2	31.3	22.3	23.5
				190	836.6	31.5	22.5	
				251	848.8	31.7	22.6	
			2	128	824.2	30.7	24.7	25.5
				190	836.6	30.9	24.8	
				251	848.8	31.0	25.0	
			3	128	824.2	29.6	25.4	25.7
				190	836.6	29.8	25.5	
				251	848.8	29.9	25.6	
			4	128	824.2	28.6	25.5	26.0
				190	836.6	28.7	25.7	
				251	848.8	28.7	25.7	
	EGPRS (8PSK)	MCS5	1	128	824.2	26.6	17.5	18.5
				190	836.6	26.5	17.4	
				251	848.8	26.6	17.5	
			2	128	824.2	25.2	19.2	19.5
				190	836.6	25.3	19.3	
				251	848.8	25.4	19.4	
			3	128	824.2	24.0	19.7	20.2
				190	836.6	24.1	19.8	
				251	848.8	24.2	19.9	
			4	128	824.2	22.7	19.6	20.0
				190	836.6	22.7	19.7	
				251	848.8	22.8	19.8	

Notes:

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

- Head & Body-worn: GMSK Voice Mode
- Head VoIP & Hotspot mode: GMSK (GPRS) mode with 4 time slots
- SAR is not required for EGPRS (8PSK) mode because its output power is less than that of GPRS Mode

GSM1900 Measured Results

Band	Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Max. Pwr		Frame Pwr Maximum
						Burst (dBm)	Frame (dBm)	
1900	GSM (Voice)	CS1	1	512	1850.2	28.6	19.5	20.0
				661	1880.0	28.3	19.3	
				810	1909.8	28.4	19.4	
	GPRS (GMSK)	CS1	1	512	1850.2	28.6	19.6	20.0
				661	1880.0	28.3	19.2	
				810	1909.8	28.4	19.4	
			2	512	1850.2	26.7	20.7	21.5
				661	1880.0	26.7	20.7	
				810	1909.8	27.2	21.1	
			3	512	1850.2	25.2	20.9	21.2
				661	1880.0	25.1	20.8	
				810	1909.8	25.5	21.2	
			4	512	1850.2	23.8	20.8	21.5
				661	1880.0	23.8	20.8	
				810	1909.8	24.2	21.2	
	EGPRS (8PSK)	MCS5	1	512	1850.2	24.6	15.5	16.5
				661	1880.0	24.6	15.6	
				810	1909.8	25.0	16.0	
			2	512	1850.2	22.6	16.6	17.5
				661	1880.0	22.7	16.7	
				810	1909.8	23.2	17.2	
			3	512	1850.2	21.5	17.2	18.2
				661	1880.0	21.5	17.3	
				810	1909.8	22.3	18.0	
			4	512	1850.2	20.2	17.2	18.5
				661	1880.0	20.2	17.2	
				810	1909.8	21.0	18.0	

Notes:

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

- Head & Body-worn: GMSK Voice Mode
- Head VoIP & Hotspot mode: GMSK (GPRS) mode with 4 time slots
- SAR is not required for EGPRS (8PSK) mode because its output power is less than that of GPRS Mode

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
	βc/βd	8/15

HSDPA Setup Procedures used to establish the test signals

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

	Mode	HSDPA	HSDPA	HSDPA	HSDPA
	Subtest	1	2	3	4
W-CDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set 1			
	Power Control Algorithm	Algorithm 2			
	βc	2/15	11/15	15/15	15/15
	βd	15/15	15/15	8/15	4/15
	Bd (SF)	64			
	βc/βd	2/15	12/15	15/8	15/4
	βhs	4/15	24/15	30/15	30/15
	MPR (dB)	0	0	0.5	0.5
HSDPA Specific Settings	D_{ACK}	8			
	D_{NAK}	8			
	DCQI	8			
	Ack-Nack repetition factor	3			
	CQI Feedback (Table 5.2B.4)	4ms			
	CQI Repetition Factor (Table 5.2B.4)	2			
	Ahs=βhs/βc	30/15			

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

The following 5 Sub-tests were completed according to Release 6 procedures in section 5.2 of 3GPP TS34.121. A summary of these settings are illustrated below:

	Mode	HSPA				
	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
	βc	11/15	6/15	15/15	2/15	15/15
	βd	15/15	15/15	9/15	15/15	0
	βec	209/225	12/15	30/15	2/15	5/15
	βc/βd	11/15	6/15	15/9	2/15	15/1
	βhs	22/15	12/15	30/15	4/15	5/15
	βed	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				
	Ahs = βhs/βc	30/15				
HSUPA Specific Settings	E-DPDCCH	6	8	8	5	7
	DHARQ	0	0	0	0	0
	AG Index	20	12	15	17	21
	ETFCI (from 34.121 Table C.11.1.3)	75	67	92	71	81
	Associated Max UL Data Rate kbps	242.1	174.9	482.8	205.8	308.9
	Reference E-TFCIs	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 Channelisation Codes	2xSF2				SF4

HSPA+

Since 16QAM is not used for uplink, the uplink Category and release is same as HSUPA, i.e., Rel. 7 Therefore, the RF conducted power is not measured.

W-CDMA Band II Measured Results

Band	Mode		UL Ch No.	Freq. (MHz)	Max. Pwr		Reduction Pwr	
					MPR (dB)	Avg. Pwr (dBm)	MPR (dB)	Avg. Pwr (dBm)
W-CDMA Band II	Rel 99	RMC, 12.2 kbps	9262	1852.4	0	21.8	0	20.2
			9400	1880.0	0	21.7	0	19.8
			9538	1907.6	0	22.0	0	20.0
	HSDPA	Subtest 1	9262	1852.4	0	21.8	0	20.1
			9400	1880.0	0	21.6	0	19.6
			9538	1907.6	0	22.0	0	20.0
		Subtest 2	9262	1852.4	0	21.5	0	20.2
			9400	1880.0	0	21.4	0	19.7
			9538	1907.6	0	21.7	0	20.0
		Subtest 3	9262	1852.4	0.5	21.5	0	20.3
			9400	1880.0	0.5	21.1	0	19.7
			9538	1907.6	0.5	21.4	0	20.0
		Subtest 4	9262	1852.4	0.5	20.1	0	20.2
			9400	1880.0	0.5	19.7	0	19.6
			9538	1907.6	0.5	20.1	0	20.0
	HSUPA	Subtest 1	9262	1852.4	0	21.0	0	19.2
			9400	1880.0	0	20.7	0	18.7
			9538	1907.6	0	21.2	0	19.1
		Subtest 2	9262	1852.4	2	18.9	0	19.3
			9400	1880.0	2	18.7	0	18.8
			9538	1907.6	2	19.0	0	19.1
		Subtest 3	9262	1852.4	1	21.0	0	19.2
			9400	1880.0	1	20.7	0	18.7
			9538	1907.6	1	21.0	0	19.1
		Subtest 4	9262	1852.4	2	18.9	0	19.3
			9400	1880.0	2	18.6	0	19.0
			9538	1907.6	2	19.0	0	19.1
		Subtest 5	9262	1852.4	0	21.8	0	20.2
			9400	1880.0	0	21.6	0	19.6
			9538	1907.6	0	22.0	0	20.0

W-CDMA Band V Measured Results

Band	Mode		UL Ch No.	Freq. (MHz)	Max. Pwr	
					MPR (dB)	Avg. Pwr (dBm)
W-CDMA Band V	Rel 99	RMC, 12.2 kbps	4132	826.4	0	23.2
			4183	836.6	0	23.2
			4233	846.6	0	23.1
	HSDPA	Subtest 1	4132	826.4	0	21.9
			4183	836.6	0	22.1
			4233	846.6	0	22.0
		Subtest 2	4132	826.4	0	21.3
			4183	836.6	0	21.5
			4233	846.6	0	21.4
		Subtest 3	4132	826.4	0.5	21.8
			4183	836.6	0.5	22.0
			4233	846.6	0.5	21.9
		Subtest 4	4132	826.4	0.5	20.1
			4183	836.6	0.5	20.3
			4233	846.6	0.5	20.2
	HSUPA	Subtest 1	4132	826.4	0	21.2
			4183	836.6	0	21.3
			4233	846.6	0	21.2
		Subtest 2	4132	826.4	2	19.1
			4183	836.6	2	19.2
			4233	846.6	2	19.1
		Subtest 3	4132	826.4	1	19.7
			4183	836.6	1	19.8
			4233	846.6	1	19.7
		Subtest 4	4132	826.4	2	19.1
			4183	836.6	2	19.2
			4233	846.6	2	19.1
		Subtest 5	4132	826.4	0	21.6
			4183	836.6	0	21.7
			4233	846.6	0	21.6

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 3

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

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

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

Network Signalling value	Requirements (sub-clause)	E-UTRA Band	Channel bandwidth (MHz)	Resources Blocks (N_{RB})	A-MPR (dB)
NS_01	6.6.2.1.1	Table 5.5-1	1.4, 3, 5, 10, 15, 20	Table 5.6-1	NA
NS_03	6.6.2.2.1	2, 4,10, 23, 25, 35, 36	3	>5	≤ 1
			5	>6	≤ 1
			10	>6	≤ 1
			15	>8	≤ 1
			20	>10	≤ 1
NS_04	6.6.2.2.2	41	5	>6	≤ 1
			10, 15, 20	See Table 6.2.4-4	
NS_05	6.6.3.3.1	1	10,15,20	≥ 50	≤ 1
NS_06	6.6.2.2.3	12, 13, 14, 17	1.4, 3, 5, 10	Table 5.6-1	n/a
NS_07	6.6.2.2.3 6.6.3.3.2	13	10	Table 6.2.4-2	Table 6.2.4-2
NS_08	6.6.3.3.3	19	10, 15	> 44	≤ 3
NS_09	6.6.3.3.4	21	10, 15	> 40	≤ 1
				> 55	≤ 2
NS_10		20	15, 20	Table 6.2.4-3	Table 6.2.4-3
NS_11	6.6.2.2.1	23[1]	1.4, 3, 5, 10	Table 6.2.4-5	Table 6.2.4-5
..					
NS_32	-	-	-	-	-

Note 1: Applies to the lower block of Band 23, i.e. a carrier placed in the 2000-2010 MHz region.

LTE Band 5 Measured Results

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Max. Avg Pwr (dBm)		
						829 MHz	836.5 MHz	844 MHz
LTE Band 5	10	QPSK	1	0	0		23.0	
			1	25	0		22.9	
			1	49	0		22.9	
			25	0	1		21.1	
			25	12	1		21.0	
			25	25	1		21.0	
			50	0	1		21.1	
		16QAM	1	0	1		21.7	
			1	25	1		21.6	
			1	49	1		21.6	
			25	0	2		20.1	
			25	12	2		20.1	
			25	25	2		20.1	
			50	0	2		20.0	
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Max. Avg Pwr (dBm)		
						826.5 MHz	836.5 MHz	846.5 MHz
LTE Band 5	5	QPSK	1	0	0	22.9	23.1	22.9
			1	12	0	22.9	23.0	22.8
			1	24	0	22.9	23.0	22.8
			12	0	1	22.1	22.1	22.0
			12	7	1	22.1	22.1	22.0
			12	13	1	22.1	22.0	22.0
			25	0	1	22.1	22.1	22.0
		16QAM	1	0	1	21.2	21.3	21.4
			1	12	1	21.1	21.2	21.3
			1	24	1	21.1	21.2	21.4
			12	0	2	21.0	21.0	20.9
			12	7	2	21.0	21.0	20.9
			12	13	2	20.9	21.0	20.9
			25	0	2	21.1	21.0	21.0
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Max. Avg Pwr (dBm)		
						825.5 MHz	836.5 MHz	847.5 MHz
LTE Band 5	3	QPSK	1	0	0	23.1	23.0	23.1
			1	8	0	23.0	22.9	23.0
			1	14	0	23.1	23.0	23.1
			8	0	1	22.1	22.1	22.0
			8	4	1	22.1	22.1	22.1
			8	7	1	22.1	22.1	22.0
			15	0	1	22.1	22.1	22.1
		16QAM	1	0	1	21.2	21.6	21.3
			1	8	1	21.0	21.5	21.2
			1	14	1	21.1	21.5	21.2
			8	0	2	21.0	20.8	20.9
			8	4	2	21.0	20.8	20.9
			8	7	2	21.0	20.8	20.9
			15	0	2	21.0	21.0	20.9

LTE Band 5 Measured Results (continued)

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Max. Avg Pwr (dBm)		
						824.7 MHz	836.5 MHz	848.3 MHz
LTE Band 5	1.4	QPSK	1	0	0	23.1	23.1	23.0
			1	3	0	23.1	23.1	23.0
			1	5	0	23.2	23.1	23.0
			3	0	0	23.0	23.0	23.0
			3	1	0	23.0	23.0	23.0
			3	3	0	23.1	23.0	23.0
			6	0	1	22.1	22.1	22.0
		16QAM	1	0	1	21.5	21.7	21.5
			1	3	1	21.5	21.7	21.5
			1	5	1	21.6	21.7	21.5
			3	0	1	21.4	21.5	21.6
			3	1	1	21.3	21.4	21.5
			3	3	1	21.3	21.4	21.5
			6	0	2	21.1	20.9	20.9

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

9.4. Wi-Fi 2.4GHz (DTS Band)

Measured Results (Max Power)

Mode	Data Rate	Ch #	Freq. (MHz)	Avg Pwr (dBm)	Max Output Power (dBm)	SAR Test (Yes/No)	Note(s)
802.11b	1 Mbps	1	2412	17.2	17.5	Yes	
		6	2437	17.0			
		11	2462	17.5			
		12	2467	6.7	7.5	No	
		13	2472	7.0			
802.11g	6 Mbps	1	2412	Not Require	13.5	No	1
		6	2437				
		11	2462				
		12	2467		7.5		
		13	2472				
802.11n (HT20)	6.5 Mbps	1	2412	Not Require	13.5	No	1
		6	2437				
		11	2462				
		12	2467		5.5		
		13	2472				

Measured Results (Reduction Power)

Mode	Data Rate	Ch #	Freq. (MHz)	Avg Pwr (dBm)	Max Output Power (dBm)	SAR Test (Yes/No)	Note(s)
802.11b	1 Mbps	1	2412	13.7	14.5	Yes	
		6	2437	13.4			
		11	2462	14.0			
		12	2467	6.7	7.5	No	
		13	2472	7.0			
802.11g	6 Mbps	1	2412	Not Require	13.5	No	1
		6	2437				
		11	2462				
		12	2467		7.5		
		13	2472				
802.11n (HT20)	6.5 Mbps	1	2412	Not Require	13.5	No	1
		6	2437				
		11	2462				
		12	2467		5.5		
		13	2472				

Note(s):

1. Output Power and SAR is not required for 802.11g/n HT20 channels 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.

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

Measured Results

Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	Max Pwr.		
					Avg Pwr (dBm)	Max Output Power (dBm)	SAR Test (Yes/No)
5.3 (U-NII 2A)	802.11a	6 Mbps	52	5260	13.5	13.5	Yes
			56	5280	13.2		
			60	5300	13.4		
			64	5320	13.2		
	802.11n (HT20)	6.5 Mbps	52	5260	13.3	13.5	No
			56	5280	13.2		
			60	5300	13.1		
			64	5320	13.0		
	802.11n (HT40)	13.5 Mbps	54	5270	Not Required	12.5	No
			62	5310			
5.5 (U-NII 2C)	802.11a	6 Mbps	100	5500	12.6	13.5	Yes
			120	5600	13.0		
			124	5620	13.0		
			144	5720	13.2		
	802.11n (HT20)	6.5 Mbps	100	5500	13.5	13.5	No
			120	5600	12.8		
			124	5620	12.8		
			144	5720	12.7		
	802.11n (HT40)	13.5 Mbps	102	5510	Not Required	12.5	No
			118	5590			
			126	5630			
			142	5710			
5.8 (U-NII 3)	802.11a	6 Mbps	149	5745	13.2	13.5	Yes
			157	5785	13.2		
			165	5825	13.4		
	802.11n (HT20)	6.5 Mbps	149	5745	12.9	13.5	No
			157	5785	13.0		
			165	5825	12.9		
	802.11n (HT40)	13.5 Mbps	151	5755	Not Required	12.5	No
			159	5795			

Note(s):

1. Output power measurement is required for multiple configurations of the same channel bandwidth that have the same specified maximum output power according to Appendix C in KDB 248227.
2. 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.
3. When the specified maximum output power is the same for both UNII band I and UNII band 2A, begin SAR measurement in UNII band 2A; and if the highest *reported* SAR for UNII band 2A is
   - ≤ 1.2 W/kg, SAR is not required for UNII band I
   - > 1.2 W/kg, both bands should be tested independently for SAR.

9.6. Bluetooth

Maximum tune-up tolerance limit is 9 dBm from the rated nominal maximum output power. This power level qualifies for exclusion of SAR testing.

10. Measured and Reported (Scaled) SAR Results

SAR Test Reduction criteria are as follows:

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.

Additional 1-g SAR testing at 5 mm is not required. For hotspot mode, 10-g extremity SAR is not required for the surfaces and edges since all 1-g reported SAR < 1.2 W/kg. **(for Phablet only)**

KDB 941225 D01 SAR test for 3G devices:
When the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤ ¼ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode

KDB 941225 D05 SAR for LTE Devices:
SAR must be measured with the maximum TTI(transmit time interval) supported by the device in each LTE configuration.
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.

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.
  - 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.
  - 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.
  - 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*.

TCB Workshop October, 2016 ; Page 18, DUT Holder Perturbations:

When the highest *reported* SAR of an antenna is > 1.2 W/kg, holder perturbation verification is required for each antenna, using the highest SAR configuration among all applicable frequency bands.

10.1. GSM850

RF Exposure Conditions	Mode	PWR 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	Voice	Off	0	Left Touch	190	836.6	32.5	31.5	0.277	0.348	
				Left Tilt	190	836.6	32.5	31.5	0.148	0.186	
				Right Touch	190	836.6	32.5	31.5	0.200	0.251	
				Right Tilt	190	836.6	32.5	31.5	0.134	0.168	
Head (VoIP)	GPRS 4 Slot		0	Left Touch	190	836.6	29.0	28.7	0.469	0.507	1
				Left Tilt	190	836.6	29.0	28.7	0.280	0.303	
				Right Touch	190	836.6	29.0	28.7	0.365	0.395	
				Right Tilt	190	836.6	29.0	28.7	0.261	0.282	
Body-worn	Voice	Off	15	Rear	190	836.6	32.5	31.5	0.299	0.376	
				Front	190	836.6	32.5	31.5	0.285	0.358	
Body-worn(VoIP)	GPRS 4 Slot		15	Rear	190	836.6	29.0	28.7	0.580	0.627	2
				Front	190	836.6	29.0	28.7	0.481	0.520	
Hotspot	GPRS 4 Slot		10	Rear	190	836.6	29.0	28.7	0.694	0.750	3
				Front	190	836.6	29.0	28.7	0.531	0.574	
				Edge 3	190	836.6	29.0	28.7	0.169	0.183	
				Edge 4	190	836.6	29.0	28.7	0.537	0.580	

10.2. GSM1900

RF Exposure Conditions	Mode	PWR 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	Voice	Off	0	Left Touch	661	1880.0	29.0	28.3	0.158	0.186	
				Left Tilt	661	1880.0	29.0	28.3	0.059	0.069	
				Right Touch	661	1880.0	29.0	28.3	0.087	0.102	
				Right Tilt	661	1880.0	29.0	28.3	0.074	0.087	
Head (VoIP)	GPRS 4 Slot		0	Left Touch	661	1880.0	24.5	23.8	0.177	0.208	4
				Left Tilt	661	1880.0	24.5	23.8	0.069	0.081	
				Right Touch	661	1880.0	24.5	23.8	0.095	0.112	
				Right Tilt	661	1880.0	24.5	23.8	0.085	0.099	
Body-worn	Voice	Off	15	Rear	661	1880.0	29.0	28.3	0.150	0.176	
				Front	661	1880.0	29.0	28.3	0.201	0.236	
Body-worn(VoIP)	GPRS 4 Slot		15	Rear	661	1880.0	24.5	23.8	0.156	0.183	
				Front	661	1880.0	24.5	23.8	0.228	0.268	5
Hotspot	GPRS 4 Slot		10	Rear	661	1880.0	24.5	23.8	0.253	0.297	
				Front	661	1880.0	24.5	23.8	0.357	0.419	6
				Edge 3	661	1880.0	24.5	23.8	0.274	0.322	
				Edge 4	661	1880.0	24.5	23.8	0.170	0.200	

10.3. W-CDMA Band II

RF Exposure Conditions	Mode	PWR 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	Off	0	Left Touch	9400	1880.0	22.5	21.7	0.365	0.442	7
				Left Tilt	9400	1880.0	22.5	21.7	0.132	0.160	
				Right Touch	9400	1880.0	22.5	21.7	0.207	0.251	
				Rightt Tilt	9400	1880.0	22.5	21.7	0.158	0.192	
Body-Worn	Rel 99 RMC	Off	15	Rear	9400	1880.0	22.5	21.7	0.331	0.401	
				Front	9400	1880.0	22.5	21.7	0.499	0.605	8
Hotspot	Rel 99 RMC	On	10	Rear	9400	1880.0	20.5	19.8	0.388	0.456	
				Front	9400	1880.0	20.5	19.8	0.519	0.610	9
				Edge 3	9400	1880.0	20.5	19.8	0.339	0.398	
				Edge 4	9400	1880.0	20.5	19.8	0.250	0.294	

10.4. W-CDMA Band V

RF Exposure Conditions	Mode	PWR 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	Off	0	Left Touch	4183	836.6	23.5	23.2	0.311	0.331	10
				Left Tilt	4183	836.6	23.5	23.2	0.122	0.130	
				Right Touch	4183	836.6	23.5	23.2	0.234	0.249	
				Rightt Tilt	4183	836.6	23.5	23.2	0.130	0.138	
Body-Worn	Rel 99 RMC	Off	15	Rear	4183	836.6	23.5	23.2	0.314	0.334	11
				Front	4183	836.6	23.5	23.2	0.263	0.280	
Hotspot	Rel 99 RMC		10	Rear	4183	836.6	23.5	23.2	0.497	0.528	12
				Front	4183	836.6	23.5	23.2	0.284	0.302	
				Edge 3	4183	836.6	23.5	23.2	0.155	0.165	
				Edge 4	4183	836.6	23.5	23.2	0.298	0.317	

10.5. LTE Band 5 (10MHz Bandwidth)

RF Exposure Conditions	Mode	PWR Back-off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	RB Allocation	RB offest	Power (dBm)		1-g SAR (W/kg)		Plot No.
									Tune-up limit	Meas.	Meas.	Scaled	
Head	QPSK	Off	0	Left Touch	20525	836.5	1	0	23.5	23.0	0.322	0.362	13
							25	0	22.5	21.1	0.192	0.267	
				Left Tilt	20525	836.5	1	0	23.5	23.0	0.112	0.126	
							25	0	22.5	21.1	0.113	0.157	
				Right Touch	20525	836.5	1	0	23.5	23.0	0.262	0.294	
							25	0	22.5	21.1	0.157	0.218	
				Right Tilt	20525	836.5	1	0	23.5	23.0	0.209	0.235	
							25	0	22.5	21.1	0.129	0.179	
Body-Worn	QPSK	Off	15	Rear	20525	836.5	1	0	23.5	23.0	0.408	0.458	14
							25	0	22.5	21.1	0.195	0.271	
				Front	20525	836.5	1	0	23.5	23.0	0.294	0.330	
							25	0	22.5	21.1	0.205	0.285	
Hotspot	QPSK		10	Rear	20525	836.5	1	0	23.5	23.0	0.474	0.532	15
							25	0	22.5	21.1	0.291	0.405	
				Front	20525	836.5	1	0	23.5	23.0	0.357	0.401	
							25	0	22.5	21.1	0.221	0.307	
				Edge 3	20525	836.5	1	0	23.5	23.0	0.178	0.200	
							25	0	22.5	21.1	0.106	0.147	
				Edge 4	20525	836.5	1	0	23.5	23.0	0.300	0.337	
							25	0	22.5	21.1	0.176	0.245	

10.6. Wi-Fi (DTS Band)

Frequency Band	Mode	RF Exposure Conditions	PWR Back-off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Power (dBm)		1-g SAR (W/kg)		Notes	Plot No.
									Tune-up limit	Meas.	Meas.	Scaled		
2.4GHz	802.11b 1 Mbps	Head	Off	0	Left Touch	11	2462	0.052	14.5	14.0				
					Left Tilt	11	2462	0.040	14.5	14.0				
					Right Touch	11	2462	0.138	14.5	14.0	0.092	0.105	1	16
					Rightt Tilt	11	2462	0.110	14.5	14.0				
		Body-worn	Off	15	Rear	11	2462	0.018	17.5	17.5				
					Front	11	2462	0.036	17.5	17.5	0.027	0.028	1	17
		Hotspot & Wi-Fi Direct		10	Rear	11	2462	0.043	17.5	17.5				
					Front	11	2462	0.079	17.5	17.5	0.060	0.060	1	18
					Edge 1	11	2462	0.038	17.5	17.5				
					Edge 4	11	2462	0.028	17.5	17.5				

Note(s):

1. Highest *reported* SAR is ≤ 0.4 W/kg. Therefore, further SAR measurements within this exposure condition are not required.
2. Highest *reported* SAR is > 0.4 W/kg. Due to the highest *reported* SAR for this test position, other test positions in Head exposure condition were evaluated until a SAR ≤ 0.8 W/kg was *reported*.
3. Testing for a second channel was required because the *reported* SAR for this test position was >0.8 W/kg.
4. Additional testing required in order satisfying FCC simultaneous transmission limit criteria.

10.7. Wi-Fi (U-NII Band)

Frequency Band	Mode	RF Exposure Conditions	PWR Back-off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Power (dBm)		1-g SAR (W/kg)		Notes	Plot No.
									Tune-up limit	Meas.	Meas.	Scaled		
5.3GHz (U-NII-2A)	802.11a 6 Mbps	Head	Off	0	Left Touch	52	5260	0.027	13.5	13.5				
					Left Tilt	52	5260	0.025	13.5	13.5				
					Right Touch	52	5260	0.047	13.5	13.5	0.019	0.019	1	19
					Rightt Tilt	52	5260	0.031	13.5	13.5				
		Body-worn	Off	15	Rear	52	5260	0.184	13.5	13.5	0.091	0.092	1	20
					Front	52	5260	0.007	13.5	13.5				
Frequency Band	Mode	RF Exposure Conditions	PWR Back-off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Power (dBm)		1-g SAR (W/kg)		Notes	Plot No.
									Tune-up limit	Meas.	Meas.	Scaled		
5.5GHz (U-NII-2C)	802.11a 6 Mbps	Head	Off	0	Left Touch	144	5720	0.025	13.5	13.2				
					Left Tilt	144	5720	0.028	13.5	13.2				
					Right Touch	144	5720	0.051	13.5	13.2	0.023	0.025	1	21
					Rightt Tilt	144	5720	0.049	13.5	13.2				
		Body-worn	Off	15	Rear	144	5720	0.319	13.5	13.2	0.140	0.151	1	22
					Front	144	5720	0.006	13.5	13.2				
Frequency Band	Mode	RF Exposure Conditions	PWR Back-off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Power (dBm)		1-g SAR (W/kg)		Notes	Plot No.
									Tune-up limit	Meas.	Meas.	Scaled		
5.8GHz (U-NII-3)	802.11a 6 Mbps	Head	On	0	Left Touch	165	5825	0.022	13.5	13.4				
					Left Tilt	165	5825	0.022	13.5	13.4				
					Right Touch	165	5825	0.036	13.5	13.4	0.017	0.017	1	23
					Rightt Tilt	165	5825	0.033	13.5	13.4				
		Body-worn	Off	15	Rear	165	5825	0.211	13.5	13.4	0.097	0.099	1	24
					Front	165	5825	0.004	13.5	13.4				
		Wi-Fi Direct		10	Rear	149	5745	0.536	13.5	13.2	0.198	0.213	1	25
					Front	149	5745	0.060	13.5	13.2				
					Edge 1	149	5745	0.048	13.5	13.2				
					Edge 4	149	5745	0.223	13.5	13.2				

Note(s):

1. Highest reported SAR is ≤ 0.4 W/kg. Therefore, further SAR measurements within this exposure condition are not required.
2. Highest reported SAR is > 0.4 W/kg. Due to the highest reported SAR for this test position, other test positions in Head exposure condition were evaluated until a SAR ≤ 0.8 W/kg was reported.
3. Testing for a second channel was required because the reported SAR for this test position was >0.8 W/kg.
4. Additional testing required in order satisfying FCC simultaneous transmission limit criteria.

10.8. Bluetooth

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:

[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)]·[√f(GHz)] ≤ 3.0, for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

- $f_{(GHz)}$ 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:

- *(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)]·[√$f_{(GHz)}$/x]* 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 Accessory Exposure Conditions

Max. tune-up tolerance limit		Min. test separation distance (mm)	Frequency (GHz)	SAR test exclusion Result*	Test Configuration	Estimated 1-g SAR (W/kg)
(dBm)	(mW)					
9.0	8	15	2.480	0.8	Rear/Front	0.112

Conclusion:

*: The computed value is < 3; therefore, Bluetooth 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 < 0.80 or 2.0 W/kg (1-g or 10-g respectively); steps 2) through 4) do not apply.
2) When the original highest measured SAR is ≥ 0.80 or 2.0 W/kg (1-g or 10-g respectively), repeat that measurement once.
3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 or 3.6 W/kg (~ 10% from the 1-g or 10-g respective SAR limit).
4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥1.5 or 3.75 W/kg (1-g or 10-g respectively) and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

Frequency Band (MHz)	Air Interface	RF Exposure Conditions	Test Position	Repeated SAR (Yes/No)	Highest Measured SAR (W/kg)	Repeated Measured SAR (W/kg)	Largest to Smallest SAR Ratio
835	GSM850	Hotspot	Rear	No	0.694	N/A	N/A
	WCDMA Band V	Hotspot	Rear	No	0.497	N/A	N/A
	LTE Band 5	Hotspot	Rear	No	0.474	N/A	N/A
1900	GSM 1900	Hotspot	Front	No	0.357	N/A	N/A
	WCDMA Band II	Hotspot	Front	No	0.519	N/A	N/A
2400	Wi-Fi 802.11b/g/n	Head	Right Touch	No	0.092	N/A	N/A
5300	Wi-Fi 802.11a/n/ac	Body	Rear	No	0.091	N/A	N/A
5500	Wi-Fi 802.11a/n/ac	Body	Rear	No	0.140	N/A	N/A
5800	Wi-Fi 802.11a/n/ac	Wi-Fi Direct	Rear	No	0.198	N/A	N/A

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 not > 1.20.

12. Simultaneous Transmission SAR Analysis

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

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

Where:

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

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

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

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

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

Simultaneous Transmission Condition

RF Exposure Condition	Item	Capable Transmit Configurations		
Head	1	GSM(Voice/GPRS)	+	DTS
	2	GSM(Voice/GPRS)	+	U-NII
	3	W-CDMA	+	DTS
	4	W-CDMA	+	U-NII
	5	LTE	+	DTS
	6	LTE	+	U-NII
Body-worn	7	GSM(Voice/GPRS)	+	DTS
	8	GSM(Voice/GPRS)	+	U-NII
	9	GSM(Voice/GPRS)	+	BT
	10	W-CDMA	+	DTS
	11	W-CDMA	+	U-NII
	12	W-CDMA	+	BT
	13	LTE	+	DTS
	14	LTE	+	U-NII
	15	LTE	+	BT
Hotspot	16	GSM(GPRS)	+	DTS
	17	WCDMA	+	DTS
	18	LTE	+	DTS

Notes:

1. DTS supports Hotspot, Wi-Fi Direct and VoIP.
2. UNII supports Wi-Fi Direct and VoIP and not suppots Hotspot.
3. GPRS, W-CDMA, LTE supports Hotspot and VoIP.
4. DTS Radio cannot transmit simultaneously with Bluetooth Radio.
5. UNII Radio cannot transmit simultaneously with Bluetooth Radio.
6. UNII Radio cannot transmit simultaneously with DTS Radio.

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

RF Exposure conditions	① WWAN	② DTS	③ UNII	④ BT	① + ② WWAN + DTS		① + ③ WWAN + UNII		① + ④ WWAN + BT	
					∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)	∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)	∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)
Head	0.507	0.105	0.025		0.612	No	0.532	No		
Body -worn	0.627	0.028	0.151	0.112	0.655	No	0.778	No	0.739	No
Hotspot	0.750	0.060			0.810	No				

Conclusion:

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

Appendixes

Refer to separated files for the following appendixes.

4787833362-S1V2 FCC Report SAR_App A_Photos & Ant. Locations

4787833362-S1V2 FCC Report SAR_App B_Highest SAR Test Plots

4787833362-S1V2 FCC Report SAR_App C_System Check Plots

4787833362-S1V2 FCC Report SAR_App D_SAR Tissue Ingredients

4787833362-S1V2 FCC Report SAR_App E_Probe Cal. Certificates

4787833362-S1V2 FCC Report SAR_App F_Dipole Cal. Certificates

END OF REPORT