



SAR EVALUATION REPORT

**FCC 47 CFR § 2.1093
IEEE Std 1528-2013**

For
GSM/WCDMA/LTE PHONE + BLUETOOTH, DTS/UNII a/b/g/n & NFC

**FCC ID: ZNFH443
Model Name: LG-H443, H443, LGH443**

**Report Number: 14I19589-S1A
Issue Date: 2/9/2015**

Prepared for
**LG ELECTRONICS MOBILECOMM U.S.A., INC.
1000 SYLVAN AVE.
ENGLEWOOD CLIFFS, NJ 07632**

Prepared by
**UL Verification Services Inc.
47173 Benicia Street
Fremont, CA 94538, U.S.A.
TEL: (510) 771-1000
FAX: (510) 661-0888**



NVLAP LAB CODE 200065-0

Revision History

Rev.	Date	Revisions	Revised By
--	2/3/2015	Initial Issue	--
A	2/9/2015	Section 1: Updated Highest Reported SAR Section 6.3: Updated Target Power for Wi-Fi 2.4GHz Sections 9.4: Updated Wi-Fi 2.4GHz Power Sections 10.9: Updated Tune-up Limits Section 12: Updated Sum of SAR	Coltyce Sanders

Table of Contents

1. Attestation of Test Results 5

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

3. Facilities and Accreditation 6

4. SAR Measurement System & Test Equipment 7

 4.1. SAR Measurement System..... 7

 4.2. SAR Scan Procedures..... 8

 4.3. Test Equipment..... 10

5. Measurement Uncertainty..... 11

6. Device Under Test (DUT) Information 12

 6.1. DUT Description 12

 6.2. Wireless Technologies..... 12

 6.3. Nominal and Maximum Output Power..... 13

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

7. RF Exposure Conditions (Test Configurations)..... 15

8. Dielectric Property Measurements & System Check 16

 8.1. Dielectric Property Measurements 16

 8.2. System Check..... 20

9. Conducted Output Power Measurements..... 23

 9.1. GSM 23

 9.2. W-CDMA 24

 9.3. LTE..... 29

 9.4. Wi-Fi 2.4GHz..... 34

 9.5. Wi-Fi 5GHz..... 35

 9.6. Bluetooth 35

10. Measured and Reported (Scaled) SAR Results..... 36

 10.1. GSM850..... 38

 10.2. GSM1900..... 38

 10.3. W-CDMA Band V 39

 10.4. W-CDMA Band II..... 39



 10.5. LTE Band 2 (10MHz Bandwidth) 40

 10.6. LTE Band 4 (10MHz Bandwidth) 40

 10.7. LTE Band 5 (10MHz Bandwidth) 41

10.8.	<i>LTE Band 17 (10MHz Bandwidth)</i>	41
10.9.	<i>Wi-Fi 2.4 GHz SAR</i>	42
10.10.	<i>Wi-Fi 5 GHz SAR</i>	42
10.11.	<i>Bluetooth</i>	43
11.	SAR Measurement Variability	44
12.	Simultaneous Transmission SAR Analysis	45
12.1.	<i>Sum of the SAR for GSM850 & Wi-Fi & BT</i>	46
12.2.	<i>Sum of the SAR for GSM1900 & Wi-Fi & BT</i>	46
12.3.	<i>Sum of the SAR for WCDMA Band V & Wi-Fi & BT</i>	47
12.4.	<i>Sum of the SAR for WCDMA Band II & Wi-Fi & BT</i>	47
12.5.	<i>Sum of the SAR for LTE Band 2 & Wi-Fi & BT</i>	48
12.6.	<i>Sum of the SAR for LTE Band 4 & Wi-Fi & BT</i>	48
12.7.	<i>Sum of the SAR for LTE Band 5 & Wi-Fi & BT</i>	49
12.8.	<i>Sum of the SAR for LTE Band 17 & Wi-Fi & BT</i>	49
	<i>Conclusion:</i>	49
Appendixes		50
A_	<i>14I19589v0 SAR Photos & Ant. Locations</i>	50
B_	<i>14I19589v0 SAR Highest Test Plots</i>	50
C_	<i>14I19589v0 SAR System Check Plots</i>	50
D_	<i>14I19589v0 SAR Tissue Ingredients</i>	50
E_	<i>14I19589v0 SAR Probe Cal. Certificates</i>	50
F_	<i>14I19589v0 SAR Dipole Cal. Certificates</i>	50

1. Attestation of Test Results

Applicant Name	LG ELECTRONICS MOBILECOMM U.S.A., INC.			
FCC ID	ZNFH443			
Model Name	LG-H443, H443, LGH443			
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	1.021	0.533	0.636	N/A
Body-worn*	1.044	0.131	0.404	
Hotspot/Wi-Fi Direct	1.044	0.131	0.404	
Simultaneous Tx	1.448	1.272	1.448	
Date Tested	12/8/2014 to 12/18/2014			
Test Results	Pass			
<p>UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.</p> <p>Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government (NIST Handbook 150, Annex A). This report is written to support regulatory compliance of the applicable standards stated above.</p>				
Approved & Released By:		Prepared By:		
				
Devin Chang Senior Engineer UL Verification Services Inc.		AJ Newcomer Laboratory Technician UL Verification Services Inc.		

2. Test Specification, Methods and Procedures

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

- 248227 D01 SAR meas for 802.11 v02
- 447498 D01 General RF Exposure Guidance v05r02
- 648474 D04 Handset SAR v01r02
- 690783 D01 SAR Listings on Grants v01r03
- 865664 D01 SAR measurement 100 MHz to 6 GHz v01r03
- 865664 D02 RF Exposure Reporting v01r01
- 941225 D01 3G SAR Procedures v03
- 941225 D05 SAR for LTE Devices v02r03
- 941225 D06 Hotspot Mode v02

3. Facilities and Accreditation

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

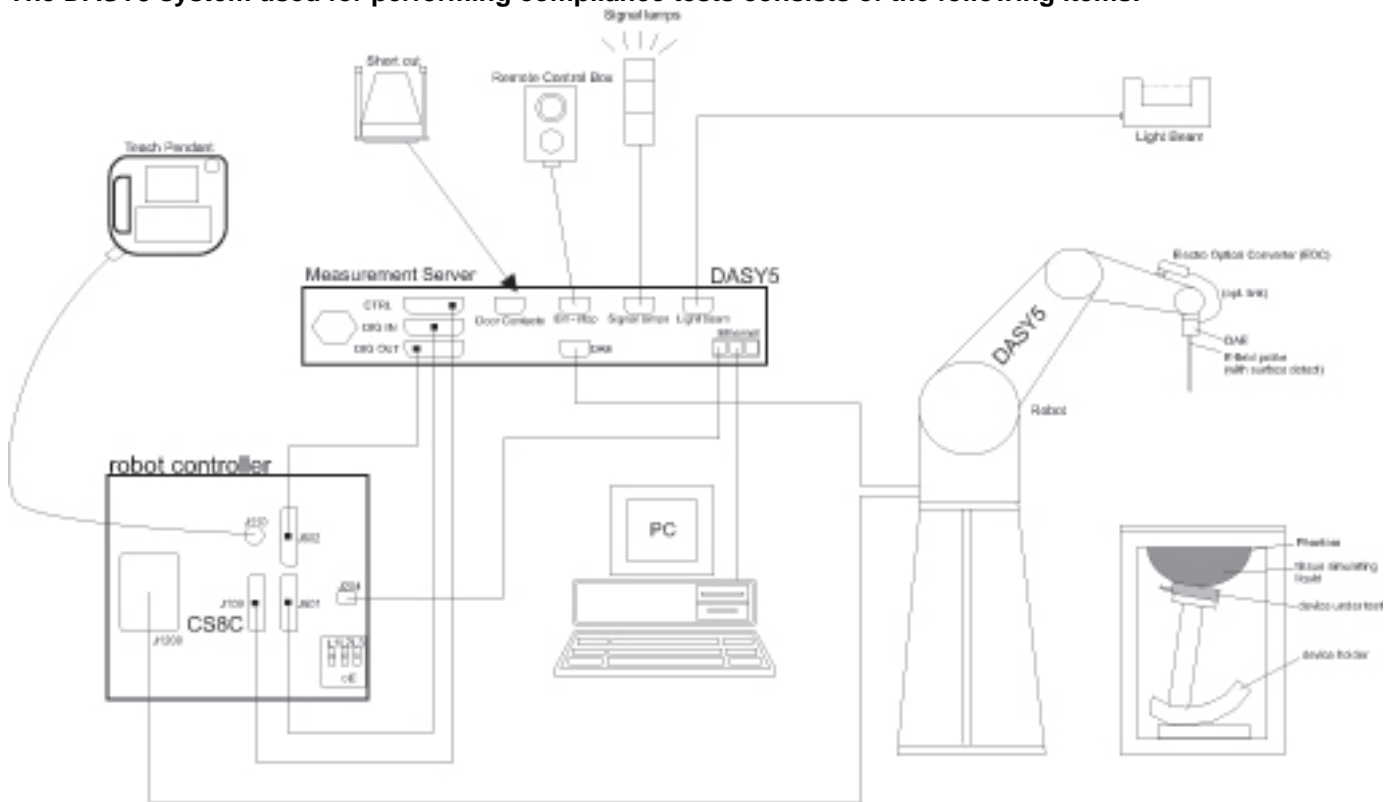
47173 Benicia Street	47266 Benicia Street
SAR Lab A	SAR Lab 1
SAR Lab B	SAR Lab 2
SAR Lab C	SAR Lab 3
SAR Lab D	SAR Lab 4
SAR Lab E	SAR Lab 5
SAR Lab F	
SAR Lab G	
SAR Lab H	

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: 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 \leq the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

Step 3: Zoom Scan

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

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

		≤ 3 GHz	> 3 GHz	
Maximum zoom scan spatial resolution: $\Delta x_{Zoom}, \Delta y_{Zoom}$		≤ 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 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
		$\Delta z_{Zoom}(n>1)$: between subsequent points	$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z	≥ 30 mm	3 – 4 GHz: ≥ 28 mm 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 area scan based <i>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.

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	E753ES	MY40000980	4/7/2015
Dielectronic Probe kit	SPEAG	DAK-3.5	1082	9/16/2015
Dielectronic Probe kit	SPEAG	DAK-3.5 Short	SM DAK 200 BA	N/A
Thermometer	Control Company	4242	122529163	10/8/2015
Thermometer	EXTECH	445703	CCS-200	3/24/2015

System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
HP Signal Generator	HP	8665B	3546A00784	6/23/2015
Power Meter	HP	437B	3125U09516	10/6/2015
Power Meter	Agilent	N1911A	MY53060016	8/7/2015
Power Sensor	Agilent	E9323A	MY53070003	5/1/2015
Power Sensor	Agilent	8481A	3318A95392	10/6/2015
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1622052	N/A
Bi-directional coupler	Werlatone, Inc.	C8060-102	2711	N/A
DC Power Supply	Sorensen Ametek	XT20-3	1318A00530	N/A
Synthesized Signal Generator	Agilent	8665B	3438A00633	7/10/2015
Power Meter	HP	437B	3125U11347	8/27/2015
Power Meter	HP	437B	3125U16345	6/16/2015
Power Sensor	HP	8481A	2702A60780	6/16/2015
Power Sensor	HP	8481A	1926A16917	10/10/2015
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1808938	N/A
Bi-directional coupler	Werlatone, Inc.	C8060-102	2710	N/A
DC Power Supply	HP	6296A	2841A-05955	N/A
E-Field Probe (SAR 1)	SPEAG	EX3DV4	3902	5/19/2015
E-Field Probe (SAR 2)	SPEAG	EX3DV3	3871	8/26/2015
E-Field Probe (SAR 3)	SPEAG	EX3DV4	3773	4/22/2015
E-Field Probe (SAR 4)	SPEAG	EX3DV4	3929	5/9/2015
E-Field Probe (SAR 5)	SPEAG	EX3DV4	3991	5/16/2015
Data Acquisition Electronics (SAR 1)	SPEAG	DAE3	427	1/21/2015
Data Acquisition Electronics (SAR 2)	SPEAG	DAE4	1359	2/17/2015
Data Acquisition Electronics (SAR 3)	SPEAG	DAE4	1380	7/23/2015
Data Acquisition Electronics (SAR 4)	SPEAG	DAE4	1377	8/27/2015
Data Acquisition Electronics (SAR 5)	SPEAG	DAE4	1439	5/14/2015
System Validation Dipole	SPEAG	D750V3	1019	3/17/2015
System Validation Dipole	SPEAG	D835V2	4d142	9/9/2015
System Validation Dipole	SPEAG	D1750V2	1050	4/22/2015
System Validation Dipole	SPEAG	D1900V2	5d163	9/11/2015
System Validation Dipole	SPEAG	D2450V2	748	2/18/2015
System Validation Dipole	SPEAG	D5GHzV2	1003	2/26/2015
Thermometer (SAR Lab 1)	EXTECH	445703	CCS-205	3/24/2015
Thermometer (SAR Lab 2)	EXTECH	445703	CCS-203	3/28/2015
Thermometer (SAR Lab 3)	EXTECH	445703	CCS-237	6/3/2015
Thermometer (SAR Lab 4)	EXTECH	445703	CCS-238	6/3/2015
Thermometer (SAR Lab 5)	EXTECH	445703	CCS-239	6/3/2015

Others

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Power Meter	Agilent	N1912A	MY53040015	7/10/2015
Power Sensor	Agilent	N1921A	MY52020011	5/6/2015
Base Station Simulator	R & S	CMW500	135393-VQ	7/3/2015

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): 133.25 mm x 66.12 mm Overall Diagonal: 143 mm Display Diagonal: 120 mm
Battery Back Cover	<input type="checkbox"/> Normal Battery Cover <input checked="" type="checkbox"/> Normal Battery Cover with NFC <input type="checkbox"/> Wireless Charger Battery Cover <input type="checkbox"/> Wireless Charger Battery Cover with NFC <input type="checkbox"/> The rechargeable battery is not user accessible.
Battery Options	<input checked="" type="checkbox"/> Standard – Lithium-ion battery, Rating 3.8Vdc, 8.0Wh <input type="checkbox"/> Extended (large capacity) <input type="checkbox"/> The rechargeable battery is not user accessible.
Accessory	Headset
Wireless Router (Hotspot)	Wi-Fi Hotspot mode permits the device to share its cellular data connection with other Wi-Fi-enabled devices. <input checked="" type="checkbox"/> Mobile Hotspot (Wi-Fi 2.4 GHz) <input checked="" type="checkbox"/> Mobile Hotspot (Wi-Fi 5 GHz) (U-NII 3 only)
Wi-Fi Direct	Wi-Fi Direct enabled devices transfer data directly between each other <input checked="" type="checkbox"/> Wi-Fi Direct (Wi-Fi 2.4 GHz) <input checked="" type="checkbox"/> Wi-Fi Direct (Wi-Fi 5 GHz) (U-NII 3 only)

6.2. Wireless Technologies

Wireless technologies	Frequency bands	Operating mode	Duty Cycle used for SAR testing
GSM	850 1900	Voice (GMSK) GPRS (GMSK) EGPRS (8PSK)	GSM Voice: 12.5%; (E)GPRS: 1 Slot: 12.5%; 2 Slots: 25%,
	GPRS Multi-Slot Class: <input type="checkbox"/> Class 8 - One Up <input checked="" type="checkbox"/> Class 10 - Two Up <input type="checkbox"/> Class 12 - Four Up <input type="checkbox"/> Class 33 - Four Up DTM (Dual Transfer Mode): Not supported		
W-CDMA (UMTS)	Band II Band V	UMTS Rel. 99 (Voice & Data) HSDPA (Rel. 7) HSUPA (Rel. 6) DC-HSDPA (Rel. 8) HSPA+ (Rel. 6)	100%
LTE (FDD)	Band 2 Band 4 Band 5 Band 17	QPSK 16QAM	100%
	Does this device SV-LTE (1xRTT-LTE)? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
Wi-Fi	2.4 GHz	802.11b 802.11g 802.11n (HT20)	100%
	5 GHz	802.11a 802.11n (HT20) 802.11n (HT40)	100%
	TDWR (Terminal Doppler Weather Radar): Not supported.		
Bluetooth	2.4 GHz	Version 4.0 LE	77.5% (DH5)

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		RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit
GSM850	Voice	32.7	33.2
	GPRS 1 slot	32.7	33.2
	GPRS 2 slots	31.2	31.7
	EGPRS 1 slots	27.2	27.7
	EGPRS 2 slots	27.2	27.7
GSM1900	Voice	29.7	30.2
	GPRS 1 slot	29.7	30.2
	GPRS 2 slots	29.2	29.7
	EGPRS 1 slots	26.2	26.7
	EGPRS 2 slots	26.2	26.7
W-CDMA Band V	R99	23.7	24.2
	HSDPA	23.7	24.2
	HSUPA	23.7	24.2
	DC-HSDPA	23.7	24.2
W-CDMA Band II	R99	23.2	23.7
	HSDPA	23.2	23.7
	HSUPA	23.2	23.7
	DC-HSDPA	23.2	23.7
LTE Band 2	QPSK	23.2	23.7
LTE Band 4	QPSK	23.2	23.7
LTE Band 5	QPSK	23.2	23.7
LTE Band 17	QPSK	23.2	23.7

Upper limit (dB): ~ 1.0		RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit
WiFi 2.4 GHz	802.11b	14.5	15.5
	802.11g	11.0	12.0
	802.11n HT20	9.5	10.5
WiFi 5 GHz	802.11a	10.6	11.6
	802.11n HT20	10.3	11.3
	802.11n HT40	9.0	10.0
Bluetooth		7.0	8.0
Bluetooth LE		0.0	1.0

6.4. General LTE SAR Test and Reporting Considerations

Item	Description																																																																																																																																																																
Frequency range, Channel Bandwidth, Numbers and Frequencies	<table border="1"> <tr> <td rowspan="3">Band 2</td> <td colspan="6">Frequency range: 1850 - 1910 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>18650/ 1855</td> <td>18625/ 1852.5</td> <td></td> <td></td> </tr> <tr> <td>Mid</td> <td></td> <td></td> <td>18900/ 1880</td> <td>18900/ 1880</td> <td></td> <td></td> </tr> <tr> <td>High</td> <td></td> <td></td> <td>19150/ 1905</td> <td>19175/ 1907.5</td> <td></td> <td></td> </tr> <tr> <td rowspan="3">Band 4</td> <td colspan="6">Frequency range: 1710 - 1755 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>20000/ 1715</td> <td>19975/ 1712.5</td> <td></td> <td></td> </tr> <tr> <td>Mid</td> <td></td> <td></td> <td>20175/ 1732.5</td> <td>20175/ 1732.5</td> <td></td> <td></td> </tr> <tr> <td>High</td> <td></td> <td></td> <td>20350/ 1750</td> <td>20375/ 1752.5</td> <td></td> <td></td> </tr> <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></td> <td></td> </tr> <tr> <td>Mid</td> <td></td> <td></td> <td>20525/ 836.5</td> <td>20525/ 836.5</td> <td></td> <td></td> </tr> <tr> <td>High</td> <td></td> <td></td> <td>20600/ 844</td> <td>20625/ 846.5</td> <td></td> <td></td> </tr> <tr> <td rowspan="3">Band 17</td> <td colspan="6">Frequency range: 704 - 716 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></td> <td>23755/ 706.5</td> <td></td> <td></td> </tr> <tr> <td>Mid</td> <td></td> <td></td> <td>23790/ 710</td> <td>23790/ 710</td> <td></td> <td></td> </tr> <tr> <td>High</td> <td></td> <td></td> <td></td> <td>23825/ 713.5</td> <td></td> <td></td> </tr> </table>	Band 2	Frequency range: 1850 - 1910 MHz						Channel Bandwidth						20 MHz	15 MHz	10 MHz	5 MHz	3 MHz	1.4 MHz	Low			18650/ 1855	18625/ 1852.5			Mid			18900/ 1880	18900/ 1880			High			19150/ 1905	19175/ 1907.5			Band 4	Frequency range: 1710 - 1755 MHz						Channel Bandwidth						20 MHz	15 MHz	10 MHz	5 MHz	3 MHz	1.4 MHz	Low			20000/ 1715	19975/ 1712.5			Mid			20175/ 1732.5	20175/ 1732.5			High			20350/ 1750	20375/ 1752.5			Band 5	Frequency range: 824 - 849 MHz						Channel Bandwidth						20 MHz	15 MHz	10 MHz	5 MHz	3 MHz	1.4 MHz	Low			20450/ 829	20425/ 826.5			Mid			20525/ 836.5	20525/ 836.5			High			20600/ 844	20625/ 846.5			Band 17	Frequency range: 704 - 716 MHz						Channel Bandwidth						20 MHz	15 MHz	10 MHz	5 MHz	3 MHz	1.4 MHz	Low				23755/ 706.5			Mid			23790/ 710	23790/ 710			High				23825/ 713.5		
	Band 2		Frequency range: 1850 - 1910 MHz																																																																																																																																																														
			Channel Bandwidth																																																																																																																																																														
		20 MHz	15 MHz	10 MHz	5 MHz	3 MHz	1.4 MHz																																																																																																																																																										
	Low			18650/ 1855	18625/ 1852.5																																																																																																																																																												
	Mid			18900/ 1880	18900/ 1880																																																																																																																																																												
	High			19150/ 1905	19175/ 1907.5																																																																																																																																																												
	Band 4	Frequency range: 1710 - 1755 MHz																																																																																																																																																															
		Channel Bandwidth																																																																																																																																																															
		20 MHz	15 MHz	10 MHz	5 MHz	3 MHz	1.4 MHz																																																																																																																																																										
	Low			20000/ 1715	19975/ 1712.5																																																																																																																																																												
	Mid			20175/ 1732.5	20175/ 1732.5																																																																																																																																																												
	High			20350/ 1750	20375/ 1752.5																																																																																																																																																												
	Band 5	Frequency range: 824 - 849 MHz																																																																																																																																																															
		Channel Bandwidth																																																																																																																																																															
		20 MHz	15 MHz	10 MHz	5 MHz	3 MHz	1.4 MHz																																																																																																																																																										
	Low			20450/ 829	20425/ 826.5																																																																																																																																																												
	Mid			20525/ 836.5	20525/ 836.5																																																																																																																																																												
	High			20600/ 844	20625/ 846.5																																																																																																																																																												
	Band 17	Frequency range: 704 - 716 MHz																																																																																																																																																															
		Channel Bandwidth																																																																																																																																																															
20 MHz		15 MHz	10 MHz	5 MHz	3 MHz	1.4 MHz																																																																																																																																																											
Low				23755/ 706.5																																																																																																																																																													
Mid			23790/ 710	23790/ 710																																																																																																																																																													
High				23825/ 713.5																																																																																																																																																													
LTE transmitter and antenna implementation	LTE Band 2 has one (1) TX/RX antenna. LTE Bands 4 / 5 / 17 have one (1) TX/RX antenna and one (1) RX antenna Refer to Appendix A.																																																																																																																																																																
Maximum power reduction (MPR)	<p align="center">Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3</p> <table border="1"> <thead> <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> </thead> <tbody> <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> </tbody> </table> <p>MPR Built-in by design A-MPR (additional MPR) was disabled during SAR testing</p>	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																																																																																																																										
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																																																																																																																																																										
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.																																																																																																																																																																

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

- 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.

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 Standard 1528-2013

Dielectric Property Measurements Results:

SAR Lab 1

Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)	
12/8/2014	Head 2450	e'	38.8400	Relative Permittivity (ϵ_r):	38.84	39.20	-0.92	5
		e"	13.6200	Conductivity (σ):	1.86	1.80	3.08	5
	Head 2410	e'	38.9700	Relative Permittivity (ϵ_r):	38.97	39.28	-0.79	5
		e"	13.5100	Conductivity (σ):	1.81	1.76	2.84	5
	Head 2475	e'	38.7300	Relative Permittivity (ϵ_r):	38.73	39.17	-1.12	5
		e"	13.7100	Conductivity (σ):	1.89	1.83	3.27	5
12/8/2014	Body 2450	e'	50.9100	Relative Permittivity (ϵ_r):	50.91	52.70	-3.40	5
		e"	14.7500	Conductivity (σ):	2.01	1.95	3.04	5
	Body 2410	e'	51.0500	Relative Permittivity (ϵ_r):	51.05	52.76	-3.24	5
		e"	14.6000	Conductivity (σ):	1.96	1.91	2.57	5
	Body 2475	e'	50.8100	Relative Permittivity (ϵ_r):	50.81	52.67	-3.53	5
		e"	14.8100	Conductivity (σ):	2.04	1.99	2.67	5
12/15/2014	Head 750	e'	41.4900	Relative Permittivity (ϵ_r):	41.49	41.96	-1.12	5
		e"	22.2500	Conductivity (σ):	0.93	0.89	3.90	5
	Head 700	e'	42.0900	Relative Permittivity (ϵ_r):	42.09	42.22	-0.30	5
		e"	22.6900	Conductivity (σ):	0.88	0.89	-0.68	5
	Head 725	e'	41.7700	Relative Permittivity (ϵ_r):	41.77	42.09	-0.76	5
		e"	22.5200	Conductivity (σ):	0.91	0.89	1.87	5
12/15/2014	Body 750	e'	53.2900	Relative Permittivity (ϵ_r):	53.29	55.55	-4.06	5
		e"	23.2600	Conductivity (σ):	0.97	0.96	0.72	5
	Body 700	e'	53.8300	Relative Permittivity (ϵ_r):	53.83	55.74	-3.42	5
		e"	23.7300	Conductivity (σ):	0.92	0.96	-3.71	5
	Body 725	e'	53.4800	Relative Permittivity (ϵ_r):	53.48	55.64	-3.89	5
		e"	23.4400	Conductivity (σ):	0.94	0.96	-1.69	5
12/18/2014	Head 2450	e'	38.2100	Relative Permittivity (ϵ_r):	38.21	39.20	-2.53	5
		e"	13.8700	Conductivity (σ):	1.89	1.80	4.97	5
	Head 2410	e'	38.3700	Relative Permittivity (ϵ_r):	38.37	39.28	-2.31	5
		e"	13.7600	Conductivity (σ):	1.84	1.76	4.74	5
	Head 2475	e'	38.1100	Relative Permittivity (ϵ_r):	38.11	39.17	-2.70	5
		e"	13.9300	Conductivity (σ):	1.92	1.83	4.93	5

SAR Lab 2

Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)	
12/13/2014	Head 1750	e'	38.4900	Relative Permittivity (ϵ_r):	38.49	40.08	-3.98	5
		e"	13.7800	Conductivity (σ):	1.34	1.37	-2.05	5
	Head 1710	e'	38.6900	Relative Permittivity (ϵ_r):	38.69	40.15	-3.63	5
		e"	13.7000	Conductivity (σ):	1.30	1.35	-3.25	5
	Head 1755	e'	38.4500	Relative Permittivity (ϵ_r):	38.45	40.08	-4.06	5
		e"	13.8000	Conductivity (σ):	1.35	1.37	-1.83	5
12/13/2014	Body 1750	e'	51.1800	Relative Permittivity (ϵ_r):	51.18	53.44	-4.23	5
		e"	15.1200	Conductivity (σ):	1.47	1.49	-1.00	5
	Body 1710	e'	51.3700	Relative Permittivity (ϵ_r):	51.37	53.54	-4.06	5
		e"	15.0100	Conductivity (σ):	1.43	1.46	-2.35	5
	Body 1755	e'	51.1700	Relative Permittivity (ϵ_r):	51.17	53.43	-4.23	5
		e"	15.1100	Conductivity (σ):	1.47	1.49	-0.99	5

Dielectric Property Measurements Results: (continued)

SAR Lab 3

Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)	
12/8/2014	Head 835	e'	42.1400	Relative Permittivity (ϵ_r):	42.14	41.50	1.54	5
		e"	19.9600	Conductivity (σ):	0.93	0.90	2.97	5
	Head 820	e'	42.3100	Relative Permittivity (ϵ_r):	42.31	41.60	1.70	5
		e"	20.0000	Conductivity (σ):	0.91	0.90	1.49	5
	Head 850	e'	41.9500	Relative Permittivity (ϵ_r):	41.95	41.50	1.08	5
		e"	19.9100	Conductivity (σ):	0.94	0.92	2.84	5
12/8/2014	Body 835	e'	52.9200	Relative Permittivity (ϵ_r):	52.92	55.20	-4.13	5
		e"	21.8200	Conductivity (σ):	1.01	0.97	4.44	5
	Body 820	e'	53.0800	Relative Permittivity (ϵ_r):	53.08	55.28	-3.97	5
		e"	21.8900	Conductivity (σ):	1.00	0.97	3.06	5
	Body 850	e'	52.8100	Relative Permittivity (ϵ_r):	52.81	55.16	-4.26	5
		e"	21.7200	Conductivity (σ):	1.03	0.99	3.99	5
12/11/2014	Head 835	e'	40.5100	Relative Permittivity (ϵ_r):	40.51	41.50	-2.39	5
		e"	19.6300	Conductivity (σ):	0.91	0.90	1.27	5
	Head 820	e'	40.7700	Relative Permittivity (ϵ_r):	40.77	41.60	-2.00	5
		e"	19.6400	Conductivity (σ):	0.90	0.90	-0.33	5
	Head 850	e'	40.3700	Relative Permittivity (ϵ_r):	40.37	41.50	-2.72	5
		e"	19.5900	Conductivity (σ):	0.93	0.92	1.19	5
12/11/2014	Body 835	e'	52.9000	Relative Permittivity (ϵ_r):	52.90	55.20	-4.17	5
		e"	21.8100	Conductivity (σ):	1.01	0.97	4.39	5
	Body 820	e'	53.1700	Relative Permittivity (ϵ_r):	53.17	55.28	-3.81	5
		e"	21.9500	Conductivity (σ):	1.00	0.97	3.34	5
	Body 850	e'	52.7700	Relative Permittivity (ϵ_r):	52.77	55.16	-4.33	5
		e"	21.8800	Conductivity (σ):	1.03	0.99	4.76	5

SAR Lab 4

Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)	
12/8/2014	Head 1900	e'	38.5000	Relative Permittivity (ϵ_r):	38.50	40.00	-3.75	5
		e"	13.4000	Conductivity (σ):	1.42	1.40	1.12	5
	Head 1850	e'	38.7800	Relative Permittivity (ϵ_r):	38.78	40.00	-3.05	5
		e"	13.3400	Conductivity (σ):	1.37	1.40	-1.98	5
	Head 1910	e'	38.5100	Relative Permittivity (ϵ_r):	38.51	40.00	-3.73	5
		e"	13.4800	Conductivity (σ):	1.43	1.40	2.26	5
12/8/2014	Body 1900	e'	50.8500	Relative Permittivity (ϵ_r):	50.85	53.30	-4.60	5
		e"	14.4900	Conductivity (σ):	1.53	1.52	0.71	5
	Body 1850	e'	51.1000	Relative Permittivity (ϵ_r):	51.10	53.30	-4.13	5
		e"	14.4200	Conductivity (σ):	1.48	1.52	-2.41	5
	Body 1910	e'	50.8700	Relative Permittivity (ϵ_r):	50.87	53.30	-4.56	5
		e"	14.5500	Conductivity (σ):	1.55	1.52	1.66	5
12/11/2014	Head 1900	e'	40.3200	Relative Permittivity (ϵ_r):	40.32	40.00	0.80	5
		e"	13.0800	Conductivity (σ):	1.38	1.40	-1.30	5
	Head 1850	e'	40.4700	Relative Permittivity (ϵ_r):	40.47	40.00	1.18	5
		e"	12.9700	Conductivity (σ):	1.33	1.40	-4.70	5
	Head 1910	e'	40.2800	Relative Permittivity (ϵ_r):	40.28	40.00	0.70	5
		e"	13.0800	Conductivity (σ):	1.39	1.40	-0.78	5
12/11/2014	Body 1900	e'	52.0400	Relative Permittivity (ϵ_r):	52.04	53.30	-2.36	5
		e"	14.4100	Conductivity (σ):	1.52	1.52	0.16	5
	Body 1850	e'	52.2200	Relative Permittivity (ϵ_r):	52.22	53.30	-2.03	5
		e"	14.2300	Conductivity (σ):	1.46	1.52	-3.70	5
	Body 1910	e'	52.0400	Relative Permittivity (ϵ_r):	52.04	53.30	-2.36	5
		e"	14.3600	Conductivity (σ):	1.53	1.52	0.33	5

Dielectric Property Measurements Results: (continued)
SAR Lab 5

Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)		
12/10/2014	Head 5180	e'	36.2200	Relative Permittivity (ϵ_r):	36.22	36.01	0.57	5	
		e"	15.3100	Conductivity (σ):	4.41	4.63	-4.77	5	
	Head 5200	e'	36.2100	Relative Permittivity (ϵ_r):	36.21	35.99	0.61	5	
		e"	15.3900	Conductivity (σ):	4.45	4.65	-4.33	5	
	Head 5600	e'	35.7200	Relative Permittivity (ϵ_r):	35.72	35.53	0.52	5	
		e"	15.5700	Conductivity (σ):	4.85	5.06	-4.19	5	
	Head 5800	e'	35.4700	Relative Permittivity (ϵ_r):	35.47	35.30	0.48	5	
		e"	15.6100	Conductivity (σ):	5.03	5.27	-4.47	5	
	Head 5825	e'	35.3900	Relative Permittivity (ϵ_r):	35.39	35.30	0.25	5	
		e"	15.7100	Conductivity (σ):	5.09	5.27	-3.45	5	
	12/15/2014	Body 5180	e'	46.9700	Relative Permittivity (ϵ_r):	46.97	49.05	-4.23	5
			e"	18.0800	Conductivity (σ):	5.21	5.27	-1.21	5
Body 5200		e'	46.9900	Relative Permittivity (ϵ_r):	46.99	49.02	-4.14	5	
		e"	18.0400	Conductivity (σ):	5.22	5.29	-1.49	5	
Body 5600		e'	46.4000	Relative Permittivity (ϵ_r):	46.40	48.48	-4.29	5	
		e"	18.4000	Conductivity (σ):	5.73	5.76	-0.55	5	
Body 5800		e'	46.0000	Relative Permittivity (ϵ_r):	46.00	48.20	-4.56	5	
		e"	18.5800	Conductivity (σ):	5.99	6.00	-0.13	5	
Body 5825		e'	45.9100	Relative Permittivity (ϵ_r):	45.91	48.20	-4.75	5	
		e"	18.6900	Conductivity (σ):	6.05	6.00	0.89	5	
12/17/2014		Head 5180	e'	37.4300	Relative Permittivity (ϵ_r):	37.43	36.01	3.93	5
			e"	15.2800	Conductivity (σ):	4.40	4.63	-4.96	5
	Head 5200	e'	37.4100	Relative Permittivity (ϵ_r):	37.41	35.99	3.94	5	
		e"	15.3400	Conductivity (σ):	4.44	4.65	-4.64	5	
	Head 5600	e'	36.8900	Relative Permittivity (ϵ_r):	36.89	35.53	3.82	5	
		e"	15.5000	Conductivity (σ):	4.83	5.06	-4.62	5	
	Head 5800	e'	36.6500	Relative Permittivity (ϵ_r):	36.65	35.30	3.82	5	
		e"	15.6400	Conductivity (σ):	5.04	5.27	-4.29	5	
	Head 5825	e'	36.6600	Relative Permittivity (ϵ_r):	36.66	35.30	3.85	5	
		e"	15.6900	Conductivity (σ):	5.08	5.27	-3.57	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
D750V3	1019	3/17/2014	750	1g	8.21	8.64
				10g	5.38	5.69
D835V2	4d142	9/9/2014	835	1g	8.91	9.22
				10g	5.77	6.05
D1750V2	1050	4/22/2014	1750	1g	36.6	37.2
				10g	19.4	20.0
D1900V2	5d163	9/11/2014	1900	1g	40.8	40.6
				10g	21.2	21.4
D2450V2	748	2/18/2014	2450	1g	51.6	50.7
				10g	24.0	23.7
D5GHzV2	1003	2/26/2014	5200	1g	77.7	73.5
				10g	22.2	20.5
			5600	1g	81.8	79.6
				10g	23.2	22.1
			5800	1g	78.3	73.8
				10g	22.1	20.4

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 Lab 1

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				
12/8/2014	D2450V2	748	Head	1g	5.45	54.5	51.60	5.62	
				10g	2.45	24.5	24.00	2.08	
12/8/2014	D2450V2	748	Body	1g	5.40	54.0	50.70	6.51	1,2
				10g	2.49	24.9	23.70	5.06	
12/15/2014	D750V3	1019	Head	1g	0.767	7.67	8.21	-6.58	3,4
				10g	0.501	5.01	5.38	-6.88	
12/15/2014	D750V3	1019	Body	1g	0.870	8.70	8.64	0.69	
				10g	0.581	5.81	5.69	2.11	
12/18/2014	D2450V2	748	Head	1g	5.38	53.8	51.60	4.26	
				10g	2.43	24.3	24.00	1.25	

SAR Lab 2

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				
12/13/2014	D1750V2	1050	Head	1g	3.44	34.4	36.60	-6.01	5,6
				10g	1.83	18.3	19.40	-5.67	
12/13/2014	D1750V2	1050	Body	1g	3.70	37.0	37.20	-0.54	
				10g	1.98	19.8	20.00	-1.00	

SAR Lab 3

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				
12/8/2014	D835V2	4d142	Head	1g	0.953	9.53	8.91	6.96	7,8
				10g	0.623	6.23	5.77	7.97	
12/8/2014	D835V2	4d142	Body	1g	0.949	9.49	9.22	2.93	
				10g	0.625	6.25	6.05	3.31	
12/11/2014	D835V2	4d142	Head	1g	0.906	9.06	8.91	1.68	
				10g	0.593	5.93	5.77	2.77	
12/11/2014	D835V2	4d142	Body	1g	0.933	9.33	9.22	1.19	
				10g	0.614	6.14	6.05	1.49	

SAR Lab 4

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				
12/8/2014	D1900V2	5d163	Head	1g	4.16	41.6	40.80	1.96	
				10g	2.15	21.5	21.20	1.42	
12/8/2014	D1900V2	5d163	Body	1g	4.01	40.1	40.60	-1.23	
				10g	2.08	20.8	21.40	-2.80	
12/11/2014	D1900V2	5d163	Head	1g	3.99	39.9	40.80	-2.21	
				10g	2.06	20.6	21.20	-2.83	
12/11/2014	D1900V2	5d163	Body	1g	3.90	39.0	40.60	-3.94	9,10
				10g	2.02	20.2	21.40	-5.61	

System Check Results (continued)

SAR Lab 5

Date Tested	System Dipole		T.S. Liquid	Measured Results		Target (Ref. Value)	Delta $\pm 10\%$	Plot No.	
	Type	Serial #		Zoom Scan to 100 mW	Normalize to 1 W				
12/10/2014	5200	1003	Head	1g	7.81	78.1	77.70	0.51	
				10g	2.26	22.6	22.20	1.80	
12/10/2014	5600	1003	Head	1g	8.71	87.1	81.80	6.48	
				10g	2.48	24.8	23.20	6.90	
12/10/2014	5800	1003	Head	1g	8.32	83.2	78.30	6.26	
				10g	2.36	23.6	22.10	6.79	
12/15/2014	5200	1003	Body	1g	7.41	74.1	73.50	0.82	
				10g	2.09	20.9	20.50	1.95	
12/15/2014	5600	1003	Body	1g	8.56	85.6	79.60	7.54	
				10g	2.39	23.9	22.10	8.14	
12/15/2014	5800	1003	Body	1g	7.99	79.9	73.80	8.27	11,12
				10g	2.23	22.3	20.40	9.31	
12/17/2014	5200	1003	Head	1g	7.98	79.8	77.70	2.70	
				10g	2.32	23.2	22.20	4.50	
12/17/2014	5600	1003	Head	1g	8.59	85.9	81.80	5.01	
				10g	2.45	24.5	23.20	5.60	
12/17/2014	5800	1003	Head	1g	8.24	82.4	78.30	5.24	
				10g	2.35	23.5	22.10	6.33	

9. Conducted Output Power Measurements

9.1. GSM

GSM850 Measured Results

Band	Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Burst Pwr (dBm)	Frame Pwr (dBm)
850	GSM (Voice)	CS1	1	128	824.2	32.6	23.6
				190	836.6	32.7	23.7
				251	848.8	32.4	23.4
	GPRS (GMSK)	CS1	1	128	824.2	32.6	23.6
				190	836.6	32.7	23.7
				251	848.8	32.4	23.4
			2	128	824.2	31.3	25.3
				190	836.6	31.4	25.4
				251	848.8	31.4	25.4
	EGPRS (8PSK)	MCS5	1	128	824.2	27.7	18.7
				190	836.6	27.7	18.7
				251	848.8	27.6	18.6
2			128	824.2	27.7	21.7	
			190	836.6	27.7	21.7	
			251	848.8	27.5	21.5	

Notes:

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

- Head & Body-worn Accessory: GMSK Voice Mode
- Hotspot mode: GMSK (GPRS) mode with 2 time slots, based on the output power measurements above
- 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)	Burst Pwr (dBm)	Frame Pwr (dBm)
1900	GSM (Voice)	CS1	1	512	1850.2	30.1	21.1
				661	1880.0	30.0	21.0
				810	1909.8	29.9	20.9
	GPRS (GMSK)	CS1	1	512	1850.2	30.1	21.1
				661	1880.0	30.0	21.0
				810	1909.8	29.9	20.9
			2	512	1850.2	29.2	23.2
				661	1880.0	29.1	23.1
				810	1909.8	29.0	23.0
	EGPRS (8PSK)	MCS5	1	512	1850.2	26.5	17.5
				661	1880.0	26.3	17.3
				810	1909.8	26.5	17.5
2			512	1850.2	26.4	20.4	
			661	1880.0	26.5	20.5	
			810	1909.8	26.5	20.5	

Notes:

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

- Head & Body-worn Accessory: GMSK Voice Mode
- Hotspot mode: GMSK (GPRS) mode with 2 time slots, based on the output power measurements above
- 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
	β_c/β_d	8/15

HSDPA Setup Procedures used to establish the test signals

The following 4 Sub-tests were completed according to Release 7 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			
	β_c	2/15	11/15	15/15	15/15
	β_d	15/15	15/15	8/15	4/15
	Bd (SF)	64			
	β_c/β_d	2/15	12/15	15/8	15/4
	β_{hs}	4/15	24/15	30/15	30/15
MPR (dB)	0	0	0.5	0.5	
HSDPA Specific Settings	D_{ACK}	8			
	D_{NAK}	8			
	DCQI	8			
	Ack-Nack repetition factor	3			
	CQI Feedback (Table 5.2B.4)	4ms			
	CQI Repetition Factor (Table 5.2B.4)	2			
	$A_{hs}=\beta_{hs}/\beta_c$	30/15			

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

The following 5 Sub-tests were completed according to Release 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
	β_c	11/15	6/15	15/15	2/15	15/15
	β_d	15/15	15/15	9/15	15/15	0
	β_{ec}	209/225	12/15	30/15	2/15	5/15
	β_c/β_d	11/15	6/15	15/9	2/15	15/1
	β_{hs}	22/15	12/15	30/15	4/15	5/15
	β_{ed}	1309/225	94/75	47/15	56/75	47/15
CM (dB)	1	3	2	3	1	
MPR (dB)	0	2	1	2	0	
HSDPA Specific Settings	DACK	8				0
	DNAK	8				0
	DCQI	8				0
	Ack-Nack repetition factor	3				
	CQI Feedback (Table 5.2B.4)	4ms				
	CQI Repetition Factor (Table 5.2B.4)	2				
	A _{hs} = β_{hs}/β_c	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 Channelization Codes	2xSF2				SF4	

DC-HSDPA Setup Procedures used to establish the test signals

The following tests were completed according to procedures in section 7.3.13 of 3GPP TS34.108 v9.5.0. A summary of these settings are illustrated below:

Downlink Physical Channels are set as per 3GPP TS34.121-1 v9.0.0 E.5.0

Table E.5.0: Levels for HSDPA connection setup

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

Call is set up as per 3GPP TS34.108 v9.5.0 sub clause 7.3.13

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

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

Parameter	Unit	Value
Nominal Avg. Inf. Bit Rate	kbps	60
Inter-TTI Distance	TTI's	1
Number of HARQ Processes	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.		

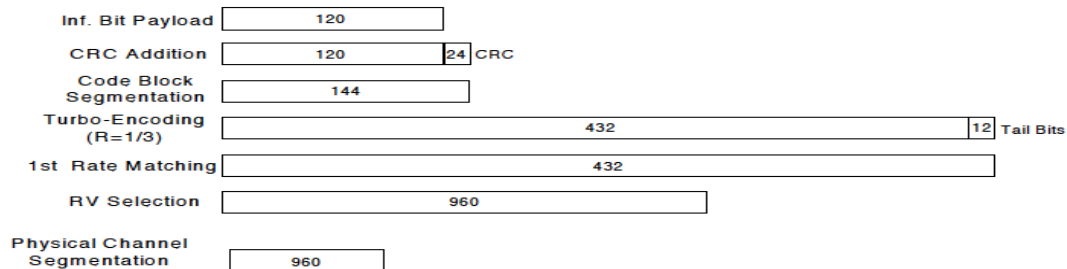


Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)

The following 4 Sub-tests for HSDPA were completed according to Release 8 procedures in section 5.2 of 3GPP TS34.121. A summary of subtest settings are illustrated below:

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

HSPA+

Since 16QAM is not used for uplink, the uplink Category and release is same as HSUPA, i.e., CAT 6 Rel 6. Therefore, the RF conducted power is not measured.

Measured Results

Band	Mode		UL Ch No.	Freq. (MHz)	MPR (dB)	Avg Pwr (dBm)
W-CDMA Band II	Rel 99	RMC, 12.2 kbps	9262	1852.4	N/A	23.2
			9400	1880.0	N/A	23.2
			9538	1907.6	N/A	23.2
	HSDPA	Subtest 1	9262	1852.4	0	23.1
			9400	1880.0	0	23.1
			9538	1907.6	0	23.1
		Subtest 2	9262	1852.4	0	23.1
			9400	1880.0	0	23.1
			9538	1907.6	0	23.1
		Subtest 3	9262	1852.4	0.5	22.6
			9400	1880.0	0.5	22.8
			9538	1907.6	0.5	22.7
		Subtest 4	9262	1852.4	0.5	22.6
			9400	1880.0	0.5	22.8
			9538	1907.6	0.5	22.7
	HSUPA	Subtest 1	9262	1852.4	0	23.2
			9400	1880.0	0	23.2
			9538	1907.6	0	23.2
		Subtest 2	9262	1852.4	2	21.3
			9400	1880.0	2	21.6
			9538	1907.6	2	21.0
		Subtest 3	9262	1852.4	1	21.8
			9400	1880.0	1	21.7
			9538	1907.6	1	22.1
		Subtest 4	9262	1852.4	2	21.3
			9400	1880.0	2	21.6
			9538	1907.6	2	21.0
		Subtest 5	9262	1852.4	0	23.2
			9400	1880.0	0	23.2
			9538	1907.6	0	23.2
	DC-HSPA	Subtest 1	9262	1852.4	0	23.1
			9400	1880.0	0	23.1
			9538	1907.6	0	23.1
		Subtest 2	9262	1852.4	0	23.1
			9400	1880.0	0	23.1
			9538	1907.6	0	23.1
		Subtest 3	9262	1852.4	0.5	22.6
			9400	1880.0	0.5	22.8
			9538	1907.6	0.5	22.7
		Subtest 4	9262	1852.4	0.5	22.6
			9400	1880.0	0.5	22.8
			9538	1907.6	0.5	22.7

Band	Mode		UL Ch No.	Freq. (MHz)	MPR (dB)	Avg Pwr (dBm)
W-CDMA Band V	Rel 99	RMC, 12.2 kbps	4132	826.4	N/A	23.1
			4183	836.6	N/A	23.1
			4233	846.6	N/A	23.1
	HSDPA	Subtest 1	4132	826.4	0	23.1
			4183	836.6	0	23.1
			4233	846.6	0	23.1
		Subtest 2	4132	826.4	0	23.1
			4183	836.6	0	23.1
			4233	846.6	0	23.1
		Subtest 3	4132	826.4	0.5	22.7
			4183	836.6	0.5	22.6
			4233	846.6	0.5	22.6
		Subtest 4	4132	826.4	0.5	22.7
			4183	836.6	0.5	22.6
			4233	846.6	0.5	22.6
	HSUPA	Subtest 1	4132	826.4	0	23.1
			4183	836.6	0	23.0
			4233	846.6	0	23.0
		Subtest 2	4132	826.4	2	21.7
			4183	836.6	2	21.4
			4233	846.6	2	21.5
		Subtest 3	4132	826.4	1	21.6
			4183	836.6	1	21.5
			4233	846.6	1	21.9
		Subtest 4	4132	826.4	2	21.7
			4183	836.6	2	21.4
			4233	846.6	2	21.5
		Subtest 5	4132	826.4	0	23.1
			4183	836.6	0	23.0
			4233	846.6	0	23.0
	DC-HSPA	Subtest 1	4132	826.4	0	23.1
			4183	836.6	0	23.1
			4233	846.6	0	23.1
		Subtest 2	4132	826.4	0	23.1
			4183	836.6	0	23.1
			4233	846.6	0	23.1
		Subtest 3	4132	826.4	0.5	22.7
			4183	836.6	0.5	22.6
			4233	846.6	0.5	22.6
		Subtest 4	4132	826.4	0.5	22.7
			4183	836.6	0.5	22.6
			4233	846.6	0.5	22.6

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 Signaling 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	13	10	Table 6.2.4-2	Table 6.2.4-2
	6.6.3.3.2				
NS_08	6.6.3.3.3	19	10, 15	> 44	≤ 3
				> 40	≤ 1
NS_09	6.6.3.3.4	21	10, 15	> 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 2 Measured Results

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							1855 MHz	1880 MHz	1905 MHz
LTE Band 2	10	QPSK	1	0	0	0	23.4	23.7	23.4
			1	25	0	0	23.3	23.5	23.3
			1	49	0	0	23.3	23.4	23.3
			25	0	1	1	22.2	22.4	22.3
			25	12	1	1	22.2	22.3	22.2
			25	25	1	1	22.2	22.3	22.2
			50	0	1	1	22.2	22.4	22.2
		16QAM	1	0	1	1	22.7	22.6	22.3
			1	25	1	1	22.4	22.7	22.2
			1	49	1	1	22.7	22.7	22.3
			25	0	2	2	21.2	21.3	21.2
			25	12	2	2	21.2	21.3	21.3
			25	25	2	2	21.4	21.3	21.3
			50	0	2	2	21.3	21.3	21.2
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							1852.5 MHz	1880 MHz	1907.5 MHz
LTE Band 2	5	QPSK	1	0	0	0	23.1	23.3	23.2
			1	12	0	0	23.2	23.6	23.3
			1	24	0	0	23.2	23.3	23.3
			12	0	1	1	22.1	22.2	22.2
			12	6	1	1	22.2	22.3	22.2
			12	11	1	1	22.2	22.3	22.2
			25	0	1	1	22.2	22.3	22.2
		16QAM	1	0	1	1	22.2	22.3	22.6
			1	12	1	1	22.2	22.3	22.2
			1	24	1	1	22.1	22.2	22.1
			12	0	2	2	21.1	21.1	21.2
			12	6	2	2	21.0	21.1	21.4
			12	11	2	2	21.2	21.2	21.3
			25	0	2	2	21.3	21.5	21.2

LTE Band 4 Measured Results

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							1715 MHz	1732.5 MHz	1750 MHz
LTE Band 4	10	QPSK	1	0	0	0	23.4	23.4	23.3
			1	25	0	0	23.5	23.5	23.1
			1	49	0	0	23.4	23.4	23.1
			25	0	1	1	22.3	22.3	22.1
			25	12	1	1	22.1	22.1	22.1
			25	25	1	1	22.2	22.2	22.2
			50	0	1	1	22.2	22.2	22.1
		16QAM	1	0	1	1	22.5	22.7	22.6
			1	25	1	1	22.6	22.7	22.2
			1	49	1	1	22.6	22.3	22.2
			25	0	2	2	21.3	21.2	21.3
			25	12	2	2	21.3	21.1	21.2
			25	25	2	2	21.3	21.1	21.2
			50	0	2	2	21.1	21.1	21.0
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							1712.5 MHz	1732.5 MHz	1752.5 MHz
LTE Band 4	5	QPSK	1	0	0	0	23.2	23.1	23.3
			1	12	0	0	23.3	23.3	23.2
			1	24	0	0	23.1	23.4	23.1
			12	0	1	1	22.3	22.3	22.2
			12	6	1	1	22.1	22.2	22.1
			12	11	1	1	22.1	22.2	22.1
			25	0	1	1	22.2	22.2	22.2
		16QAM	1	0	1	1	22.7	22.2	22.5
			1	12	1	1	22.2	22.2	22.3
			1	24	1	1	22.2	21.8	22.2
			12	0	2	2	21.5	21.3	21.2
			12	6	2	2	21.3	21.1	21.2
			12	11	2	2	21.3	21.2	21.3
			25	0	2	2	21.3	21.5	21.1

LTE Band 5 Measured Results

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							829 MHz	836.5 MHz	844 MHz
LTE Band 5	10	QPSK	1	0	0	0	23.3	23.5	23.4
			1	25	0	0	23.4	23.6	23.3
			1	49	0	0	23.2	23.4	23.2
			25	0	1	1	22.4	22.4	22.3
			25	12	1	1	22.3	22.3	22.3
			25	25	1	1	22.2	22.3	22.3
			50	0	1	1	22.3	22.3	22.3
		16QAM	1	0	1	1	22.7	22.7	22.4
			1	25	1	1	22.1	22.7	22.2
			1	49	1	1	22.1	22.7	22.2
			25	0	2	2	21.3	21.2	21.2
			25	12	2	2	21.2	21.2	21.3
			25	25	2	2	21.2	21.2	21.3
			50	0	2	2	21.2	21.2	21.3
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							826.5 MHz	836.5 MHz	846.5 MHz
LTE Band 5	5	QPSK	1	0	0	0	23.3	23.3	23.3
			1	12	0	0	23.3	23.5	23.3
			1	24	0	0	23.2	23.5	23.3
			12	0	1	1	22.3	22.3	22.2
			12	6	1	1	22.3	22.3	22.2
			12	11	1	1	22.3	22.2	22.2
			25	0	1	1	22.2	22.3	22.2
		16QAM	1	0	1	1	22.6	22.2	22.5
			1	12	1	1	22.2	22.3	22.6
			1	24	1	1	21.8	22.3	22.5
			12	0	2	2	21.1	21.4	21.4
			12	6	2	2	21.0	21.3	21.4
			12	11	2	2	21.2	21.3	21.4
			25	0	2	2	21.2	21.3	21.2

LTE Band 17 Measured Results

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)
							710 MHz
LTE Band 17	10	QPSK	1	0	0	0	23.4
			1	25	0	0	23.2
			1	49	0	0	23.3
			25	0	1	1	22.2
			25	12	1	1	22.1
			25	25	1	1	22.0
			50	0	1	1	22.1
		16QAM	1	0	1	1	22.5
			1	25	1	1	22.6
			1	49	1	1	22.7
			25	0	2	2	21.2
			25	12	2	2	21.1
			25	25	2	2	21.1
			50	0	2	2	21.1
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)
							710 MHz
LTE Band 17	5	QPSK	1	0	0	0	23.3
			1	12	0	0	23.1
			1	24	0	0	23.0
			12	0	1	1	22.1
			12	6	1	1	22.1
			12	11	1	1	22.0
			25	0	1	1	22.1
		16QAM	1	0	1	1	22.2
			1	12	1	1	22.1
			1	24	1	1	22.1
			12	0	2	2	21.3
			12	6	2	2	21.2
			12	11	2	2	21.2
			25	0	2	2	21.1

Note(s):

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

9.4. Wi-Fi 2.4GHz

Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	Avg Pwr (dBm)	Max Output Power (dBm)	SAR Test (Yes/No)	Note(s)
2.4	802.11b	1 Mbps	1	2412	15.0	15.5	Yes	
			6	2437	15.5			
			11	2462	15.3			
	802.11g	6 Mbps	1	2412	Not Required	12.0	No	1
			6	2437				
			11	2462				
	802.11n (HT20)	MCS0	1	2412		10.5	No	1
			6	2437				
			11	2462				

Note(s):

- Output Power and SAR measurement is not required for 802.11g/n HT20 channels when the specified tune-up tolerances for 802.11g/n HT20 are lower than 802.11b by more than 1 dB and the measured SAR is ≤ 1.2 W/Kg.

9.5. Wi-Fi 5GHz

Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	Avg Pwr (dBm)	Max Output Power (dBm)	SAR Test (Yes/No)	Note(s)
5.2 (U-NII 1)	802.11a	6 Mbps	36	5180	11.0	11.6	No	2
			40	5200	11.0			
			44	5220	11.0			
			48	5240	11.1			
5.2 (U-NII 1)	802.11n (HT20)	6.5 Mbps	36-48	5180 - 5240	Not Required	11.3	No	1
	802.11n (HT40)	13.5 Mbps	38-46	5190 - 5230		10	No	1
5.3 (U-NII 2A)	802.11a	6 Mbps	52	5260	11.1	11.6	Yes	
			56	5280	11.0			
			60	5300	10.9			
			64	5320	10.9			
5.3 (U-NII 2A)	802.11n (HT20)	6.5 Mbps	52-64	5260 - 5320	Not Required	11.3	No	1
	802.11n (HT40)	13.5 Mbps	54-62	5270 - 5310		10	No	1
5.5 (U-NII 2C)	802.11a	6 Mbps	100	5500	10.6	11.6	Yes	
			116	5580	11.1			
			132	5660	11.6			
			140	5700	10.4			
5.5 (U-NII 2C)	802.11n (HT20)	6.5 Mbps	100-140	5500-5700	Not Required	11.3	No	1
	802.11n (HT40)	13.5 Mbps	102-134	5510-5670		10	No	1
5.8 (U-NII 3)	802.11a	6 Mbps	149	5745	10.9	11.6	Yes	
			157	5785	11.4			
			165	5825	11.6			
5.8 (U-NII 3)	802.11n (HT20)	6.5 Mbps	149-161	5745-5805	Not Required	11.3	No	1
	802.11n (HT40)	13.5 Mbps	151-159	5755-5795		10	No	1

Note(s):

- Output Power and SAR measurement is not required for 802.11n HT20/HT40 channels when the specified tune-up tolerances for 802.11n HT20/HT40 are lower than 802.11a by more than ½ dB and the measured SAR is ≤ 1.2 W/Kg.
- 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 8.00 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.

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.

KDB 248227 D01 SAR meas for 802.11 v02:

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.

10.1. GSM850

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Voice	0	Left Touch	190	836.6	33.2	32.7	0.301	0.338	1
			Left Tilt	190	836.6	33.2	32.7	0.185	0.208	
			Right Touch	190	836.6	33.2	32.7	0.399	0.448	
			Right Tilt	190	836.6	33.2	32.7	0.212	0.238	
Head VoIP	GPRS 2 Slots	0	Left Touch	190	836.6	31.7	31.4	0.399	0.428	2
			Left Tilt	190	836.6	31.7	31.4	0.253	0.271	
			Right Touch	190	836.6	31.7	31.4	0.532	0.570	
			Right Tilt	190	836.6	31.7	31.4	0.287	0.308	
Body-worn	Voice	10	Rear	190	836.6	33.2	32.7	0.416	0.467	3
			Front	190	836.6	33.2	32.7	0.402	0.451	
Body-worn(VoIP) & Hotspot	GPRS 2 Slots	10	Rear	190	836.6	31.7	31.4	0.612	0.656	4
Front			190	836.6	31.7	31.4	0.526	0.564		
Hotspot			Edge 2	190	836.6	31.7	31.4	0.366	0.392	
			Edge 3	190	836.6	31.7	31.4	0.189	0.203	
			Edge 4	190	836.6	31.7	31.4	0.315	0.338	

10.2. GSM1900

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Voice	0	Left Touch	661	1880.0	30.2	30.0	0.475	0.497	5
			Left Tilt	661	1880.0	30.2	30.0	0.178	0.186	
			Right Touch	661	1880.0	30.2	30.0	0.334	0.350	
			Right Tilt	661	1880.0	30.2	30.0	0.154	0.161	
Head VoIP	GPRS 2 Slots	0	Left Touch	512	1850.2	29.7	29.2	0.711	0.798	6
				661	1880.0	29.7	29.1	0.707	0.812	
				810	1909.8	29.7	29.0	0.786	0.923	
			Left Tilt	661	1880.0	29.7	29.1	0.269	0.309	
			Right Touch	661	1880.0	29.7	29.1	0.493	0.566	
			Right Tilt	661	1880.0	29.7	29.1	0.251	0.288	
Body-worn	Voice	10	Rear	661	1880.0	30.2	30.0	0.368	0.385	7
			Front	661	1880.0	30.2	30.0	0.377	0.395	
Body-worn(VoIP) & Hotspot	GPRS 2 Slots	10	Rear	661	1880.0	29.7	29.1	0.614	0.705	8
Front			661	1880.0	29.7	29.1	0.586	0.673		
Hotspot			Edge 3	661	1880.0	29.7	29.1	0.336	0.386	
			Edge 4	661	1880.0	29.7	29.1	0.455	0.522	

10.3. W-CDMA Band V

RF Exposure Conditions	Mode	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	0	Left Touch	4183	836.6	24.2	23.1	0.302	0.389	9
			Left Tilt	4183	836.6	24.2	23.1	0.187	0.241	
			Right Touch	4183	836.6	24.2	23.1	0.392	0.505	
			Right Tilt	4183	836.6	24.2	23.1	0.193	0.249	
Body-worn & Hotspot	Rel 99 RMC	10	Rear	4183	836.6	24.2	23.1	0.464	0.598	10
			Front	4183	836.6	24.2	23.1	0.387	0.499	
Hotspot	Rel 99 RMC	10	Edge 2	4183	836.6	24.2	23.1	0.263	0.339	
			Edge 3	4183	836.6	24.2	23.1	0.147	0.189	
			Edge 4	4183	836.6	24.2	23.1	0.201	0.259	

10.4. W-CDMA Band II

RF Exposure Conditions	Mode	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	0	Left Touch	9262	1852.4	23.7	23.1	0.732	0.840	11
				9400	1880.0	23.7	23.1	0.801	0.920	
				9538	1907.6	23.7	23.1	0.889	1.021	
			Left Tilt	9400	1880.0	23.7	23.1	0.338	0.388	
			Right Touch	9400	1880.0	23.7	23.1	0.623	0.715	
Body-worn & Hotspot	Rel 99 RMC	10	Rear	9262	1852.4	23.7	23.1	0.735	0.844	12
				9400	1880.0	23.7	23.1	0.805	0.924	
				9538	1907.6	23.7	23.1	0.909	1.044	
			Front	9262	1852.4	23.7	23.1	0.715	0.821	
				9400	1880.0	23.7	23.1	0.755	0.867	
Hotspot	Rel 99 RMC	10	Edge 3	9400	1880.0	23.7	23.1	0.442	0.507	
			Edge 4	9400	1880.0	23.7	23.1	0.563	0.646	

10.5. LTE Band 2 (10MHz Bandwidth)

RF Exposure Conditions	Mode	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	0	Left Touch	18900	1880.0	1	0	23.7	23.7	0.738	0.738	13		
						25	0	22.7	22.4	0.522	0.559			
			Left Tilt	18900	1880.0	1	0	23.7	23.7	0.336	0.336			
						25	0	22.7	22.4	0.225	0.241			
			Right Touch	18900	1880.0	1	0	23.7	23.7	0.639	0.639			
						25	0	22.7	22.4	0.471	0.505			
Right Tilt	18900	1880.0	1	0	23.7	23.7	0.306	0.306						
			25	0	22.7	22.4	0.228	0.244						
Body-worn & Hotspot	QPSK	10	Rear	18650	1855.0	1	0	23.7	23.4	0.809	0.867			
						18900	1880.0	1	0	23.7	23.7	0.881	0.881	
						25	0	22.7	22.4	0.708	0.759			
			Front	19150	1905.0	1	0	23.7	23.4	0.822	0.881			
						18650	1855.0	1	0	23.7	23.4	0.762	0.816	
						18900	1880.0	1	0	23.7	23.7	0.823	0.823	
25	0	22.7	22.4	0.641	0.687									
19150	1905.0	1	0	23.7	23.4	0.842	0.902	14						
Hotspot	QPSK	10	Edge 3	18900	1880.0	1	0	23.7	23.7	0.416	0.416			
						25	0	22.7	22.4	0.317	0.340			
			Edge 4	18900	1880.0	1	0	23.7	23.7	0.578	0.578			
						25	0	22.7	22.4	0.434	0.465			

10.6. LTE Band 4 (10MHz Bandwidth)

RF Exposure Conditions	Mode	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	0	Left Touch	20175	1732.5	1	25	23.7	23.5	0.480	0.503	15
						25	0	22.7	22.3	0.358	0.393	
			Left Tilt	20175	1732.5	1	25	23.7	23.5	0.159	0.166	
						25	0	22.7	22.3	0.124	0.136	
			Right Touch	20175	1732.5	1	25	23.7	23.5	0.316	0.331	
						25	0	22.7	22.3	0.243	0.266	
Right Tilt	20175	1732.5	1	25	23.7	23.5	0.166	0.174				
			25	0	22.7	22.3	0.120	0.132				
Body-worn & Hotspot	QPSK	10	Rear	20175	1732.5	1	25	23.7	23.5	0.722	0.756	16
						25	0	22.7	22.3	0.552	0.605	
			Front	20175	1732.5	1	25	23.7	23.5	0.624	0.653	
						25	0	22.7	22.3	0.449	0.492	
Hotspot	QPSK	10	Edge 3	20175	1732.5	1	25	23.7	23.5	0.371	0.388	
						25	0	22.7	22.3	0.293	0.321	
			Edge 4	20175	1732.5	1	25	23.7	23.5	0.340	0.356	
						25	0	22.7	22.3	0.261	0.286	

10.7. LTE Band 5 (10MHz Bandwidth)

RF Exposure Conditions	Mode	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	0	Left Touch	20525	836.5	1	25	23.7	23.6	0.333	0.341	
						25	0	22.7	22.4	0.234	0.251	
			Left Tilt	20525	836.5	1	25	23.7	23.6	0.195	0.200	
						25	0	22.7	22.4	0.142	0.152	
			Right Touch	20525	836.5	1	25	23.7	23.6	0.464	0.475	17
						25	0	22.7	22.4	0.301	0.323	
Right Tilt	20525	836.5	1	25	23.7	23.6	0.216	0.221				
			25	0	22.7	22.4	0.153	0.164				
Body-worn & Hotspot	QPSK	10	Rear	20525	836.5	1	25	23.7	23.6	0.515	0.527	18
						25	0	22.7	22.4	0.386	0.414	
			Front	20525	836.5	1	25	23.7	23.6	0.462	0.473	
						25	0	22.7	22.4	0.330	0.354	
Hotspot	QPSK	10	Edge 2	20525	836.5	1	25	23.7	23.6	0.283	0.290	
						25	0	22.7	22.4	0.217	0.233	
			Edge 3	20525	836.5	1	25	23.7	23.6	0.159	0.163	
						25	0	22.7	22.4	0.116	0.124	
			Edge 4	20525	836.5	1	25	23.7	23.6	0.240	0.246	
						25	0	22.7	22.4	0.177	0.190	

10.8. LTE Band 17 (10MHz Bandwidth)

RF Exposure Conditions	Mode	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	0	Left Touch	23790	710.0	1	0	23.7	23.4	0.177	0.190	
						25	0	22.7	22.2	0.134	0.150	
			Left Tilt	23790	710.0	1	0	23.7	23.4	0.101	0.108	
						25	0	22.7	22.2	0.076	0.085	
			Right Touch	23790	710.0	1	0	23.7	23.4	0.212	0.227	19
						25	0	22.7	22.2	0.163	0.183	
Right Tilt	23790	710.0	1	0	23.7	23.4	0.110	0.118				
			25	0	22.7	22.2	0.080	0.090				
Body-worn & Hotspot	QPSK	10	Rear	23790	710.0	1	0	23.7	23.4	0.389	0.417	20
						25	0	22.7	22.2	0.290	0.325	
			Front	23790	710.0	1	0	23.7	23.4	0.260	0.279	
						25	0	22.7	22.2	0.202	0.227	
Hotspot	QPSK	10	Edge 2	23790	710.0	1	0	23.7	23.4	0.324	0.347	
						25	0	22.7	22.2	0.245	0.275	
			Edge 3	23790	710.0	1	0	23.7	23.4	0.077	0.083	
						25	0	22.7	22.2	0.059	0.067	
			Edge 4	23790	710.0	1	0	23.7	23.4	0.164	0.176	
						25	0	22.7	22.2	0.120	0.135	

10.9. Wi-Fi 2.4 GHz SAR

Frequency Band	Mode	RF Exposure Conditions	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	0	Left Touch	6	2437.0	0.313	15.5	15.5	0.251	0.251	3	
				Left Tilt	6	2437.0	0.306						
				Right Touch	6	2437.0	0.713	15.5	15.5	0.533	0.533	1	21
				Right Tilt	6	2437.0	0.496	15.5	15.5	0.344	0.344	1	
		Body-worn & Hotspot & Wi-Fi Direct	10	Rear	6	2437.0	0.176	15.5	15.5	0.131	0.131	2	22
				Front	6	2437.0	0.130						
				Edge 1	6	2437.0	0.133						
				Edge 4	6	2437.0	0.090						

Note(s):

- 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.
- Highest reported SAR is ≤ 0.4 W/kg. Therefore, further SAR measurements within this exposure condition are not required.
- Additional testing required in order to satisfy FCC simultaneous transmission limit criteria.

10.10. Wi-Fi 5 GHz SAR

Frequency Band	Mode	RF Exposure Conditions	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		
5.3 GHz U-NII 2A	802.11a 6 Mbps	Head	0	Left Touch	52	5260.0	0.370	11.6	11.1	0.292	0.328	3	
				Left Tilt	52	5260.0	0.316						
				Right Touch	52	5260.0	1.860	11.6	11.1	0.567	0.636	1	23
				Right Tilt	52	5260.0	1.090	11.6	11.1	0.504	0.565	1	
		Body-worn	10	Rear	52	5260.0	0.451	11.6	11.1	0.239	0.268	2	24
				Front	52	5260.0	0.149						
5.5 GHz U-NII 2C	802.11a 6 Mbps	Head	0	Left Touch	132	5660.0	0.404	11.6	11.6	0.282	0.282	3	
				Left Tilt	132	5660.0	0.320						
				Right Touch	132	5660.0	1.560	11.6	11.6	0.558	0.558	1	25
				Right Tilt	132	5660.0	0.839	11.6	11.6	0.426	0.426	1	
		Body-worn	10	Rear	132	5660.0	0.778	11.6	11.6	0.402	0.402	1	26
				Front	132	5660.0	0.182	11.6	11.6	0.111	0.111	1	
5.8 GHz U-NII 3	802.11a 6 Mbps	Head	0	Left Touch	165	5825.0	0.246	11.6	11.6	0.192	0.192	3	
				Left Tilt	165	5825.0	0.191						
				Right Touch	165	5825.0	0.717	11.6	11.6	0.339	0.339	2	27
				Right Tilt	165	5825.0	0.467						
		Body-worn & Hotspot & Wi-Fi Direct	10	Rear	165	5825.0	0.634	11.6	11.6	0.404	0.404	1	28
				Front	165	5825.0	0.132						
				Edge 1	165	5825.0	0.197						
				Edge 4	165	5825.0	0.500	11.6	11.6	0.281	0.281	1	

Note(s):

- 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.
- Highest reported SAR is ≤ 0.4 W/kg. Therefore, further SAR measurements within this exposure condition are not required.
- Additional testing required in order to satisfy FCC simultaneous transmission limit criteria.

10.11. 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:

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

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

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

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

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

Body-worn 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)					
8.0	6	10	2.480	0.9	Rear/Front	0.132

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

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
750	LTE Band 17	Body-worn & Hotspot	Rear	No	0.389	N/A	N/A
850	GSM 850	Body-worn & Hotspot	Rear	No	0.612	N/A	N/A
	WCDMA Band V	Body-worn & Hotspot	Rear	No	0.464	N/A	N/A
	LTE Band 5	Body-worn & Hotspot	Rear	No	0.515	N/A	N/A
1700	LTE Band 4	Body-worn & Hotspot	Rear	No	0.722	N/A	N/A
1900	GSM 1900	Head	Left Touch	No	0.786	N/A	N/A
	WCDMA Band II	Body-worn & Hotspot	Rear	Yes	0.909	0.876	1.04
	LTE Band 2	Body-worn & Hotspot	Rear	No	0.881	N/A	N/A
2400	Wi-Fi 802.11b/g/n	Head	Right Touch	No	0.533	N/A	N/A
5300	Wi-Fi 802.11a/n/ac	Head	Right Touch	No	0.567	N/A	N/A
5500	Wi-Fi 802.11a/n/ac	Head	Right Touch	No	0.558	N/A	N/A
5800	Wi-Fi 802.11a/n/ac	Body-worn & Hotspot	Rear	No	0.404	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

Simultaneous Transmission Condition

RF Exposure Condition	Item	Capable Transmit Configurations			
Head	1	GSM(Voice)	+	Wi-Fi 2.4 GHz	
	2	GSM(Voice)	+	Wi-Fi 5 GHz	
	3	GSM(GPRS/EDGE)	+	Wi-Fi 2.4 GHz	
	4	GSM(GPRS/EDGE)	+	Wi-Fi 5 GHz	
	5	W-CDMA	+	Wi-Fi 2.4 GHz	
	6	W-CDMA	+	Wi-Fi 5 GHz	
	9	LTE	+	Wi-Fi 2.4 GHz	
	10	LTE	+	Wi-Fi 5 GHz	
Body-w orn	1	GSM(Voice)	+	Wi-Fi 2.4 GHz	
	2	GSM(Voice)	+	Wi-Fi 5 GHz	
	3	GSM(Voice)	+	BT	
	4	GSM(GPRS/EDGE)	+	Wi-Fi 2.4 GHz	
	5	GSM(GPRS/EDGE)	+	Wi-Fi 5 GHz	
	6	GSM(GPRS/EDGE)	+	BT	
	7	W-CDMA	+	Wi-Fi 2.4 GHz	
	8	W-CDMA	+	Wi-Fi 5 GHz	
	9	W-CDMA	+	BT	
	10	LTE	+	Wi-Fi 2.4 GHz	
	11	LTE	+	Wi-Fi 5 GHz	
	12	LTE	+	BT	
Hotspot & Wi-Fi Direct	1	GSM(GPRS/EDGE)	+	Wi-Fi 2.4 GHz	
	2	GSM(GPRS/EDGE)	+	Wi-Fi 5 GHz	
	3	W-CDMA	+	Wi-Fi 2.4 GHz	
	4	W-CDMA	+	Wi-Fi 5 GHz	
	7	LTE	+	Wi-Fi 2.4 GHz	
	8	LTE	+	Wi-Fi 5 GHz	
Notes:					
1. Wi-Fi 2.4GHz and U-NII 3 support Hotspot.					
2. GPRS/EDGE, W-CDMA, and LTE support Hotspot.					
3. VoIP is supported in GPRS/EDGE, W-CDMA, and LTE.					
4. Wi-Fi 2.4 GHz Radio cannot transmit simultaneously w ith Bluetooth Radio.					
5. Wi-Fi 5 GHz Radio cannot transmit simultaneously w ith Bluetooth Radio.					

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

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario				Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① GSM850	② Wi-Fi(DTS)	③ Wi-Fi(UNII)	④ Bluetooth		
Head	Left Touch	① + ②	0.428	0.251			0.679	No
		① + ③	0.428		0.328		0.756	No
	Left Tilt	① + ②	0.271	0.533			0.804	No
		① + ③	0.271		0.636		0.907	No
	Right Touch	① + ②	0.570	0.533			1.103	No
		① + ③	0.570		0.636		1.206	No
Right Tilt	① + ②	0.308	0.344			0.652	No	
	① + ③	0.308		0.565		0.873	No	
Body-w orn Accessory & Hotspot	Rear	① + ②	0.656	0.131			0.787	No
		① + ③	0.656		0.404		1.060	No
		① + ④	0.656			0.132	0.788	No
	Front	① + ②	0.564	0.131			0.695	No
		① + ③	0.564		0.111		0.675	No
		① + ④	0.564			0.132	0.696	No
Hotspot	Edge 4	① + ②	0.338	0.131			0.469	No
		① + ③	0.338		0.281		0.619	No

12.2. Sum of the SAR for GSM1900 & Wi-Fi & BT

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario				Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① GSM1900	② Wi-Fi(DTS)	③ Wi-Fi(UNII)	④ Bluetooth		
Head	Left Touch	① + ②	0.923	0.251			1.174	No
		① + ③	0.923		0.328		1.251	No
	Left Tilt	① + ②	0.309	0.533			0.842	No
		① + ③	0.309		0.636		0.945	No
	Right Touch	① + ②	0.566	0.533			1.099	No
		① + ③	0.566		0.636		1.202	No
Right Tilt	① + ②	0.288	0.344			0.632	No	
	① + ③	0.288		0.565		0.853	No	
Body-w orn Accessory & Hotspot	Rear	① + ②	0.705	0.131			0.836	No
		① + ③	0.705		0.404		1.109	No
		① + ④	0.705			0.132	0.837	No
	Front	① + ②	0.673	0.131			0.804	No
		① + ③	0.673		0.111		0.784	No
		① + ④	0.673			0.132	0.805	No
Hotspot	Edge 4	① + ②	0.522	0.131			0.653	No
		① + ③	0.522		0.281		0.803	No

12.3. Sum of the SAR for WCDMA Band V & Wi-Fi & BT

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario				Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① W-CDMA Band V	② Wi-Fi(DTS)	③ Wi-Fi(UNII)	④ Bluetooth		
Head	Left Touch	① + ②	0.389	0.251			0.640	No
		① + ③	0.389		0.328		0.717	No
	Left Tilt	① + ②	0.241	0.533			0.774	No
		① + ③	0.241		0.636		0.877	No
	Right Touch	① + ②	0.505	0.533			1.038	No
		① + ③	0.505		0.636		1.141	No
Right Tilt	① + ②	0.249	0.344			0.593	No	
	① + ③	0.249		0.565		0.814	No	
Body-worn Accessory & Hotspot	Rear	① + ②	0.598	0.131			0.729	No
		① + ③	0.598		0.404		1.002	No
		① + ④	0.598			0.132	0.730	No
	Front	① + ②	0.499	0.131			0.630	No
		① + ③	0.499		0.111		0.610	No
		① + ④	0.499			0.132	0.631	No
Hotspot	Edge 4	① + ②	0.259	0.131			0.390	No
		① + ③	0.259		0.281		0.540	No

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

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario				Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① W-CDMA Band II	② Wi-Fi(DTS)	③ Wi-Fi(U-NII)	④ Bluetooth		
Head	Left Touch	① + ②	1.021	0.251			1.272	No
		① + ③	1.021		0.328		1.349	No
	Left Tilt	① + ②	0.388	0.533			0.921	No
		① + ③	0.388		0.636		1.024	No
	Right Touch	① + ②	0.715	0.533			1.248	No
		① + ③	0.715		0.636		1.351	No
Right Tilt	① + ②	0.317	0.344			0.661	No	
	① + ③	0.317		0.565		0.882	No	
Body-worn Accessory & Hotspot	Rear	① + ②	1.044	0.131			1.175	No
		① + ③	1.044		0.404		1.448	No
		① + ④	1.044			0.132	1.176	No
	Front	① + ②	1.016	0.131			1.147	No
		① + ③	1.016		0.111		1.127	No
		① + ④	1.016			0.132	1.148	No
Hotspot	Edge 4	① + ②	0.646	0.131			0.777	No
		① + ③	0.646		0.281		0.927	No

12.5. Sum of the SAR for LTE Band 2 & Wi-Fi & BT

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario				Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① LTE Band 2	② Wi-Fi(DTS)	③ Wi-Fi(UNII)	④ Bluetooth		
Head	Left Touch	① + ②	0.738	0.251			0.989	No
		① + ③	0.738		0.328		1.066	No
	Left Tilt	① + ②	0.336	0.533			0.869	No
		① + ③	0.336		0.636		0.972	No
	Right Touch	① + ②	0.639	0.533			1.172	No
		① + ③	0.639		0.636		1.275	No
Right Tilt	① + ②	0.306	0.344			0.650	No	
	① + ③	0.306		0.565		0.871	No	
Body-w orn Accessory & Hotspot	Rear	① + ②	0.881	0.131			1.012	No
		① + ③	0.881		0.404		1.285	No
		① + ④	0.881			0.132	1.013	No
	Front	① + ②	0.902	0.131			1.033	No
		① + ③	0.902		0.111		1.013	No
		① + ④	0.902			0.132	1.034	No
Hotspot	Edge 4	① + ②	0.578	0.131			0.709	No
		① + ③	0.578		0.281		0.859	No

12.6. Sum of the SAR for LTE Band 4 & Wi-Fi & BT

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario				Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① LTE Band 4	② Wi-Fi(DTS)	③ Wi-Fi(UNII)	④ Bluetooth		
Head	Left Touch	① + ②	0.503	0.251			0.754	No
		① + ③	0.503		0.328		0.831	No
	Left Tilt	① + ②	0.166	0.533			0.699	No
		① + ③	0.166		0.636		0.802	No
	Right Touch	① + ②	0.331	0.533			0.864	No
		① + ③	0.331		0.636		0.967	No
Right Tilt	① + ②	0.174	0.344			0.518	No	
	① + ③	0.174		0.565		0.739	No	
Body-w orn Accessory & Hotspot	Rear	① + ②	0.756	0.131			0.887	No
		① + ③	0.756		0.404		1.160	No
		① + ④	0.756			0.132	0.888	No
	Front	① + ②	0.653	0.131			0.784	No
		① + ③	0.653		0.111		0.764	No
		① + ④	0.653			0.132	0.785	No
Hotspot	Edge 4	① + ②	0.286	0.131			0.417	No
		① + ③	0.286		0.281		0.567	No

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

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario				Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① LTE Band 5	② Wi-Fi(DTS)	③ Wi-Fi(UNII)	④ Bluetooth		
Head	Left Touch	① + ②	0.341	0.251			0.592	No
		① + ③	0.341		0.328		0.669	No
	Left Tilt	① + ②	0.200	0.533			0.733	No
		① + ③	0.200		0.636		0.836	No
	Right Touch	① + ②	0.475	0.533			1.008	No
		① + ③	0.475		0.636		1.111	No
Right Tilt	① + ②	0.221	0.344			0.565	No	
	① + ③	0.221		0.565		0.786	No	
Body-w orn Accessory & Hotspot	Rear	① + ②	0.527	0.131			0.658	No
		① + ③	0.527		0.404		0.931	No
		① + ④	0.527			0.132	0.659	No
	Front	① + ②	0.473	0.131			0.604	No
		① + ③	0.473		0.111		0.584	No
		① + ④	0.473			0.132	0.605	No
Hotspot	Edge 4	① + ②	0.246	0.131			0.377	No
		① + ③	0.246		0.281		0.527	No

12.8. Sum of the SAR for LTE Band 17 & Wi-Fi & BT

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario				Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① LTE Band 17	② Wi-Fi(DTS)	③ Wi-Fi(UNII)	④ Bluetooth		
Head	Left Touch	① + ②	0.190	0.251			0.441	No
		① + ③	0.190		0.328		0.518	No
	Left Tilt	① + ②	0.108	0.533			0.641	No
		① + ③	0.108		0.636		0.744	No
	Right Touch	① + ②	0.227	0.533			0.760	No
		① + ③	0.227		0.636		0.863	No
Right Tilt	① + ②	0.118	0.344			0.462	No	
	① + ③	0.118		0.565		0.683	No	
Body-w orn Accessory & Hotspot	Rear	① + ②	0.417	0.131			0.548	No
		① + ③	0.417		0.404		0.821	No
		① + ④	0.417			0.132	0.549	No
	Front	① + ②	0.279	0.131			0.410	No
		① + ③	0.279		0.111		0.390	No
		① + ④	0.279			0.132	0.411	No
Hotspot	Edge 4	① + ②	0.083	0.131			0.214	No
		① + ③	0.176		0.281		0.457	No

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.

A_14I19589v0 SAR Photos & Ant. Locations

B_14I19589v0 SAR Highest Test Plots

C_14I19589v0 SAR System Check Plots

D_14I19589v0 SAR Tissue Ingredients

E_14I19589v0 SAR Probe Cal. Certificates

F_14I19589v0 SAR Dipole Cal. Certificates

END OF REPORT