



SAR EVALUATION REPORT

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

For

GSM/WCDMA/LTE Phone + Bluetooth, DTS/UNII a/b/g/n, ANT+ & NFC

**Model: SM-A500G/DS and SM-A500G
FCC ID: A3LSMA500G**

**Report Number: 14U18553-S1
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Prepared for

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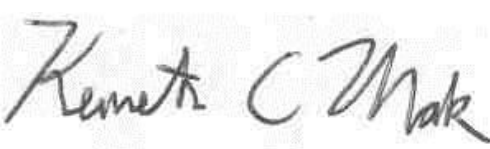
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1. Attestation of Test Results

Applicant Name	SAMSUNG ELECTRONICS CO. LTD.			
Application Purpose	☒ Original Grant ☐ Class II Permissive Change			
FCC ID	A3LSMA500G			
DUT Description	GSM/WCDMA/LTE Phone + Bluetooth, DTS/UNII a/b/g/n, ANT+ & NFC			
Exposure Category	General Population/Uncontrolled Exposure (1g SAR limit: 1.6 W/kg)			
The highest reported SAR	RF Exposure Conditions	Equipment Class		
		Licensed	DTS	UNII
	Head	0.372 W/kg	0.015 W/kg	0.410 W/kg
	Body-worn Accessory	0.937 W/kg	<0.001 W/kg	0.025 W/kg
	Wireless Router (Hotspot)	1.066 W/kg	<0.001 W/kg	N/A
	Simultaneous Transmission	Head: 0.782 W/kg Body: 0.957 W/kg	Head: 0.387 W/kg Body: 0.937 W/kg	Head: 0.782 W/kg Body: 0.957 W/kg
Highest SAR across exposure conditions	1.066 W/kg			
Applicable Standards	FCC 47 CFR § 2.1093 Published RF exposure KDB procedures IEEE Std 1528-2013			
Test Results	Pass			
Date tested	9/29/2014 – 10/8/2014			
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. 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.				
Approved & Released By:		Prepared By:		
				
Bobby Bayani Senior Engineer UL Verification Services Inc.		Kenneth Mak Laboratory Engineer UL Verification Services Inc.		

2. Test Specification, Methods and Procedures

The tests documented in this report were performed in accordance with FCC 47 CFR § 2.1093, IEEE STD 1528-2003 & 2013, the following FCC Published RF exposure KDB procedures, and TCB workshop updates:

- 447498 D01 General RF Exposure Guidance v05r02
- 648474 D04 Handset SAR v01r02
- 941225 D01 SAR test for 3G devices v02
- 941225 D03 SAR Test Reduction GSM GPRS EDGE v01
- 941225 D04 SAR for GSM E GPRS Dual Xfer Mode v01
- 941225 D05 SAR for LTE Devices v02r03
- 941225 D06 Hotspot Mode SAR v01r01
- 248227 D01 SAR Meas for 802 11abg v01r02
- 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r03
- 865664 D02 SAR Reporting v01r01
- 690783 D01 SAR Listings on Grants v01r03

3. Facilities and Accreditation

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

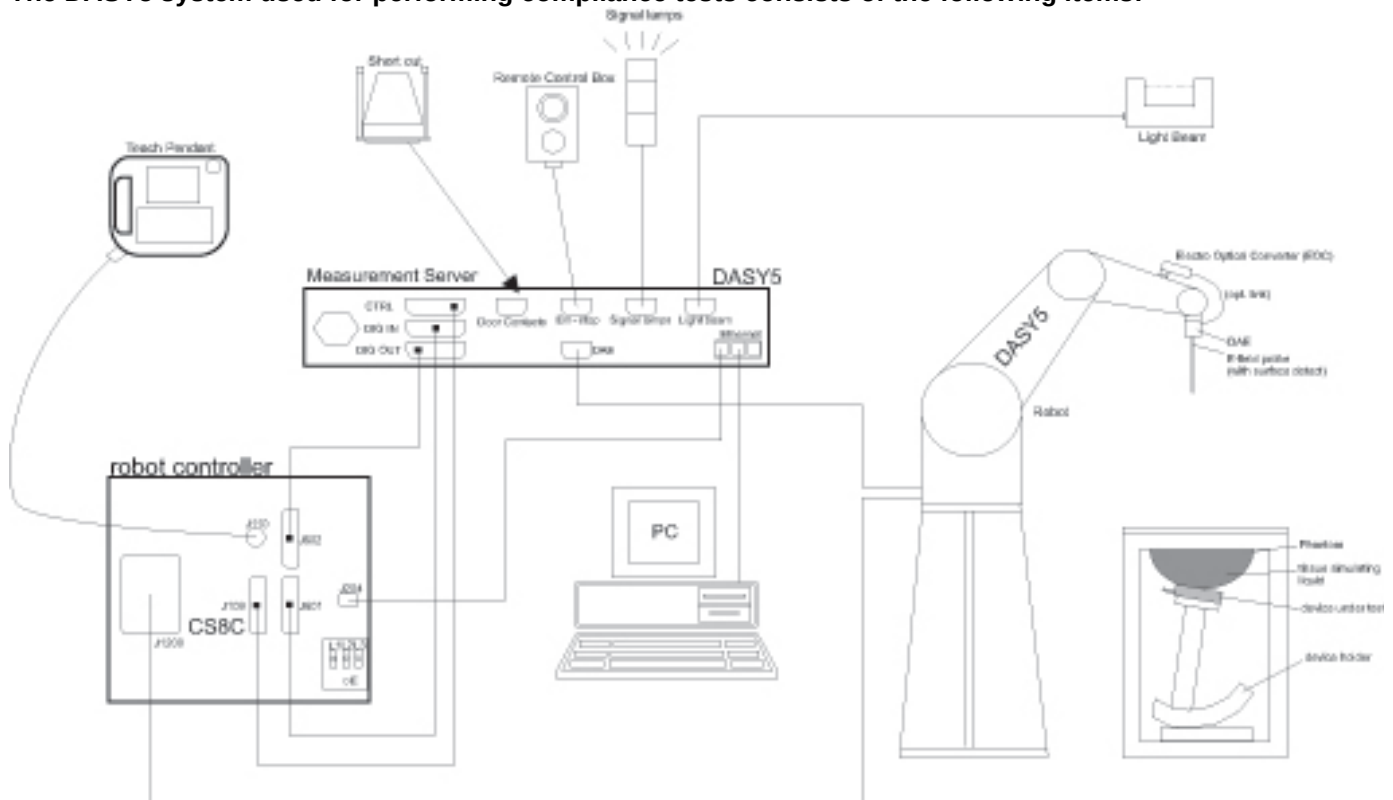
47173 Benicia Street	47266 Benicia Street
SAR Lab A	SAR Lab 1
SAR Lab B	SAR Lab 2
SAR Lab C	SAR Lab 3
SAR Lab D	SAR Lab 4
SAR Lab E	SAR Lab 5
SAR Lab F	
SAR Lab G	
SAR Lab H	

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 Procedure

Step 1: Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. The minimum distance of probe sensors to surface is 2.1 mm. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

Step 2: Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE Standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan). If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly.

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

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

Step 3: Zoom Scan

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

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

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

Step 4: Power drift measurement

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

Step 5: Z-Scan (FCC only)

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

4.3. Test Equipment

The measuring equipment used to perform the tests documented in this report has been calibrated in accordance with the manufacturers' recommendations, and is traceable to recognized national standards.

Dielectric Property Measurements

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Network Analyzer	Agilent	8753ES	MY40001647	7/17/2015
Dielectronic Probe kit	SPEAG	DAK-3.5	1103	2/18/2015
Dielectronic Probe kit	SPEAG	DAK-3.5 Short	SM DAK 200 BA	N/A
Thermometer	Yokogawa	HR 2300	46VF038	10/31/2014
Thermometer	Cole-Parmer Instrument Co.	91100-50	1007	7/31/2015
Network Analyzer	Agilent	E753ES	MY40000980	4/7/2015
Dielectronic Probe kit	SPEAG	DAK-3.5	1087	11/13/2014
Dielectronic Probe kit	SPEAG	DAK-3.5 Short	SM DAK 200 BA	N/A
Thermometer	Cole-Parmer Instrument Co.	91100-50	1007	7/31/2015

System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Synthesized Signal Generator	HP	8665B	3744A01084	5/20/2015
Power Meter	Agilent	N1912A	MY53040016	5/5/2015
Power Sensor	Agilent	E9323A	MY53070005	5/1/2015
Power Sensor	Agilent	E9323A	MY53070009	5/28/2015
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1795093	N/A
Directional coupler	Werlatone	C8060-102	2149	N/A
DC Power Supply	AMETEK	XT 15-4	1319A02778	N/A
Synthesized Signal Generator	HP	8665B	3744A01155	3/12/2015
Power Meter	Agilent	N1912A	MY52310061	12/12/2014
Power Sensor	Agilent	N1921A	MY52270022	12/12/2014
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1795092	N/A
Directional coupler	Werlatone	C8060-102	2141	N/A
DC Power Supply	BK PRECISION	1611	215-02292	N/A
Synthesized Signal Generator	Agilent	8665B	3438A00633	7/10/2015
Power Meter	Agilent	N1911A	MY53060016	8/7/2015
Power Sensor	Agilent	E9323A	MY53070003	5/1/2015
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	SPEAG	EX3DV4	3686	3/18/2015
E-Field Probe	SPEAG	EX3DV4	3990	4/15/2015
E-Field Probe	SPEAG	EX3DV4	3902	5/19/2015
E-Field Probe	SPEAG	EX3DV4	3991	5/16/2015
Data Acquisition Electronics	SPEAG	DAE3	427	1/21/2015
Data Acquisition Electronics	SPEAG	DAE4	1439	5/14/2015
Data Acquisition Electronics	SPEAG	DAE4	1434	4/14/2015
Data Acquisition Electronics	SPEAG	DAE4	1258	5/15/2015
System Validation Dipole	SPEAG	D835V2	4d002	11/15/2014
System Validation Dipole	SPEAG	D1900V2	5d140	4/23/2015
System Validation Dipole	SPEAG	D2450V2	706	5/20/2015
System Validation Dipole	SPEAG	D5GHzV2	1003	2/26/2015

Others

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Base Station Simulator	R & S	CMW500	134853-ud	7/17/2015
Base Station Simulator	R & S	CMW500	124593-ss	7/31/2015
Power Meter	Agilent	N1911A	MY53060009	5/5/2015
Power Sensor	Agilent	N1921A	MY52260009	12/12/2014

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 1528-2003 & 2013 is not required in SAR reports submitted for equipment approval.

6. Device Under Test (DUT) Information

6.1. DUT Description

Model: SM-A500G/DS and SM-A500G	
Device Dimension	Overall (Length x Width): 139.3 mm x 70.3 mm Overall Diagonal: 150.8 mm Display Diagonal: 127 mm
Battery Back Cover	☒ The rechargeable battery is not user accessible.
Battery Options	☒ The rechargeable battery is not user accessible.
Accessory	Headset
Wireless Router (Hotspot)	Wi-Fi Hotspot mode permits the device to share its cellular data connection with other Wi-Fi-enabled devices. ☒ Mobile Hotspot (Wi-Fi 2.4 GHz) ☐ Mobile Hotspot (Wi-Fi 5 GHz)
Wi-Fi Direct	Wi-Fi Direct enabled devices transfer data directly between each other ☒ Wi-Fi Direct (Wi-Fi 2.4 GHz) ☒ Wi-Fi Direct (Wi-Fi 5.2 & 5.8 GHz)

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%; GPRS/EGPRS: 1 Slot: 12.5%; 2 Slots: 25%, 3 Slots: 37.5%, 4 Slots: 50%,
	GPRS Multi-Slot Class: ☐ Class 8 - One Up ☐ Class 10 - Two Up ☐ Class 12 - Four Up ☒ Class 33 - Four Up DTM (Dual Transfer Mode): Not support		
W-CDMA (UMTS)	Band V and II	UMTS Rel. 99 (Voice & Data) HSDPA (Rel. 7, CAT 14) HSUPA (Rel. 6, CAT 6)	100%
LTE (FDD)	Band 5	QPSK, 16QAM	100%
	Does this device SV-LTE (1xRTT-LTE)? ☐ Yes ☒ No		
Wi-Fi	2.4 GHz	802.11b 802.11g 802.11n (HT20)	100%
	5 GHz	802.11a 802.11n (HT20) 802.11n (HT40)	100%
Bluetooth	2.4 GHz	Version 4.0 LE	N/A

6.3. Nominal and Maximum Output Power

Upper limit (dB): 0.5 ~ -1.5		RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit
GSM850	Voice	33.0	33.5
	GPRS 1 slot	33.0	33.5
	GPRS 2 slots	29.0	29.5
	GPRS 3 slots	28.0	28.5
	GPRS 4 slots	26.0	26.5
	EGPRS 1 slot	27.0	27.5
	EGPRS 2 slots	25.5	26.0
	EGPRS 3 slots	24.5	25.0
	EGPRS 4 slots	23.0	23.5
GSM1900	Voice	30.0	30.5
	GPRS 1 slot	30.0	30.5
	GPRS 2 slots	26.5	27.0
	GPRS 3 slots	25.0	25.5
	GPRS 4 slots	23.0	23.5
	EGPRS 1 slot	26.5	27.0
	EGPRS 2 slots	24.5	25.0
	EGPRS 3 slots	23.5	24.0
	EGPRS 4 slots	22.5	23.0
W-CDMA Band V	R99	22.5	23.0
	HSDPA	22.0	22.5
	HSUPA	22.0	22.5
W-CDMA Band II	R99	22.5	23.0
	HSDPA	22.0	22.5
	HSUPA	22.0	22.5
LTE Band 5	QPSK	22.5	23.0

Upper limit (dB): 0.5 ~ -1.5		RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit
WiFi 2.4 GHz	802.11b	15.0	15.5
	802.11g	13.0	13.5
	802.11n HT20	12.0	12.5
WiFi 5.2 GHz	802.11a	13.0	13.5
	802.11n HT20	12.0	12.5
	802.11n HT40	11.0	11.5
WiFi 5.3 GHz	802.11a	13.0	13.5
	802.11n HT20	12.0	12.5
	802.11n HT40	11.0	11.5
WiFi 5.5 GHz	802.11a	13.0	13.5
	802.11n HT20	12.0	12.5
	802.11n HT40	11.0	11.5
WiFi 5.8 GHz	802.11a	11.0	11.5
	802.11n HT20	11.0	11.5
	802.11n HT40	11.0	11.5
Bluetooth		12.0	12.5
Bluetooth LE		3.0	3.5

6.4. Simultaneous Transmission Condition

RF Exposure Condition	Capable Transmit Configurations
Head	1. GSM 850/1900 Voice + Wi-Fi 2.4/5GHz 2. GSM 850/1900 (GPRS/EDGE) + Wi-Fi 2.4/5GHz 3. WCDMA Band V / II + Wi-Fi 2.4/5GHz 4. LTE B5 + Wi-Fi 2.4/5GHz
Body-worn Accessory	1. GSM 850/1900 Voice + Wi-Fi 2.4/5GHz 2. GSM 850/1900 Voice + BT 3. GSM 850/1900 (GPRS/EDGE) + Wi-Fi 2.4/5GHz 4. GSM 850/1900 (GPRS/EDGE) + BT 5. WCDMA Band V / II + Wi-Fi 2.4/5GHz 6. WCDMA Band V / II + BT 7. LTE B5 + Wi-Fi 2.4/5GHz 8. LTE B5 + BT
Wireless Router (Hotspot)	1. GSM 850/1900 (GPRS/EDGE) + Wi-Fi 2.4GHz 2. WCDMA Band V / II + Wi-Fi 2.4GHz 3. LTE B5 + Wi-Fi 2.4GHz
Notes: 1. Wi-Fi only 2.4GHz supports Hotspot. 2. GPRS/EDGE, WCDMA and LTE support Hotspot. 3. VoIP is supported in LTE, WCDMA and GPRS. 4. Wi-Fi 2.4 GHz Radio cannot transmit simultaneously with Bluetooth Radio. 5. Wi-Fi 5 GHz Radio can transmit simultaneously with Bluetooth Radio.	

6.5. General LTE SAR Test and Reporting Considerations

Item	Description																																												
Frequency range, Channel Bandwidth, Numbers and Frequencies	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	20415/ 825.5	20407/ 824.7																																						
	Mid			20525/ 836.5	20525/ 836.5	20525/ 836.5	20525/ 836.5																																						
	High			20600/ 844	20625/ 846.5	20635/ 847.5	20643/ 848.3																																						
LTE transmitter and antenna implementation	LTE has one (1) TX/RX antennas and one (1) RX antennas Refer to Appendix 14.1. Photos and Antenna Locations.																																												
Maximum power reduction (MPR)	Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3 <table><tr><th rowspan="2">Modulation</th><th colspan="6">Channel bandwidth / Transmission bandwidth (RB)</th><th rowspan="2">MPR (dB)</th></tr><tr><th>1.4 MHz</th><th>3.0 MHz</th><th>5 MHz</th><th>10 MHz</th><th>15 MHz</th><th>20 MHz</th></tr><tr><td>QPSK</td><td>> 5</td><td>> 4</td><td>> 8</td><td>> 12</td><td>> 16</td><td>> 18</td><td>≤ 1</td></tr><tr><td>16 QAM</td><td>≤ 5</td><td>≤ 4</td><td>≤ 8</td><td>≤ 12</td><td>≤ 16</td><td>≤ 18</td><td>≤ 1</td></tr><tr><td>16 QAM</td><td>> 5</td><td>> 4</td><td>> 8</td><td>> 12</td><td>> 16</td><td>> 18</td><td>≤ 2</td></tr></table> MPR Built-in by design A-MPR (additional MPR) was disabled during SAR testing							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 “Photos and Antenna Locations” Appendix for the specific details of the antenna-to-antenna and antenna-to-edge(s) distances.

7.1. Head

For WWAN, LTE and Wi-Fi

Test Configurations	SAR Required	Note
Left Touch	Yes	
Left Tilt (15°)	Yes	
Right Touch	Yes	
Right Tilt (15°)	Yes	

7.2. Body-worn Accessory

For WWAN and LTE

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	<25 mm	Yes	
Front	<25 mm	Yes	

For Wi-Fi

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	<25 mm	Yes	
Front	<25 mm	Yes	

7.3. Wireless Router (Hotspot) & Wi-Fi Direct

For WWAN and LTE

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	<25 mm	Yes	
Front	<25 mm	Yes	
Edge 1 (Top)	124.4 mm	No	SAR is not required because the distance from the antenna to the edge is > 25 mm as per KDB 941225 D06 Hot Spot SAR
Edge 2 (Right)	26.2 mm	No	SAR is not required because the distance from the antenna to the edge is > 25 mm as per KDB 941225 D06 Hot Spot SAR
Edge 3 (Bottom)	5.6 mm	Yes	
Edge 4 (Left)	10.7 mm	Yes	

For Wi-Fi (2.4, 5.2, & 5.8GHz only)

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	<25 mm	Yes	
Front	<25 mm	Yes	
Edge 1 (Top)	2.6 mm	Yes	
Edge 2 (Right)	2.6 mm	Yes	
Edge 3 (Bottom)	128.2 mm	No	SAR is not required because the distance from the antenna to the edge is > 25 mm as per KDB 648474 D04 Handset SAR
Edge 4 (Left)	62.9 mm	No	SAR is not required because the distance from the antenna to the edge is > 25 mm as per KDB 648474 D04 Handset SAR

8. Conducted Output Power Measurements

8.1. GSM850 and GSM1900

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	33.2	24.2
				190	836.6	33.2	24.2
				251	848.8	33.1	24.1
	GPRS (GMSK)	CS1	1	128	824.2	33.2	24.2
				190	836.6	33.2	24.2
				251	848.8	33.1	24.1
			2	128	824.2	29.3	23.3
				190	836.6	29.3	23.3
				251	848.8	29.1	23.1
			3	128	824.2	28.1	23.8
				190	836.6	28.1	23.8
				251	848.8	28.0	23.7
			4	128	824.2	26.1	23.1
				190	836.6	26.1	23.1
				251	848.8	26.0	23.0
	EGPRS (8PSK)	MCS5	1	128	824.2	27.0	18.0
				190	836.6	26.8	17.8
				251	848.8	26.9	17.9
			2	128	824.2	25.5	19.5
				190	836.6	25.8	19.8
				251	848.8	25.8	19.8
			3	128	824.2	23.0	18.7
				190	836.6	23.2	18.9
				251	848.8	23.2	18.9
			4	128	824.2	22.5	19.5
				190	836.6	22.4	19.4
				251	848.8	22.2	19.2

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 1 time slot, 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	29.9	20.9
				661	1880.0	30.0	21.0
				810	1909.8	29.8	20.8
	GPRS (GMSK)	CS1	1	512	1850.2	29.9	20.9
				661	1880.0	30.0	21.0
				810	1909.8	29.8	20.8
			2	512	1850.2	26.9	20.9
				661	1880.0	26.9	20.9
				810	1909.8	26.9	20.9
			3	512	1850.2	25.0	20.7
				661	1880.0	25.1	20.8
				810	1909.8	25.2	20.9
			4	512	1850.2	23.2	20.2
				661	1880.0	23.2	20.2
				810	1909.8	23.2	20.2
	EGPRS (8PSK)	MCS5	1	512	1850.2	25.9	16.9
				661	1880.0	25.9	16.9
				810	1909.8	25.8	16.8
			2	512	1850.2	24.2	18.2
				661	1880.0	24.7	18.7
				810	1909.8	24.3	18.3
			3	512	1850.2	22.2	17.9
				661	1880.0	22.3	18.0
				810	1909.8	22.0	17.7
			4	512	1850.2	21.1	18.1
				661	1880.0	21.4	18.4
				810	1909.8	21.4	18.4

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 1 time slot, 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

8.2. W-CDMA Band V and II

Release 99

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 1
	Rel99 RMC	12.2kbps RMC
	Power Control Algorithm	Algorithm2
	β_c/β_d	8/15

Measured Results

Band	Mode	UL Ch No.	Freq. (MHz)	Avg Pwr (dBm)
W-CDMA Band V	Rel 99 (RMC, 12.2 kbps)	4132	826.4	22.9
		4183	836.6	22.9
		4233	846.6	22.7
W-CDMA Band II	Rel 99 (RMC, 12.2 kbps)	9262	1852.4	22.6
		9400	1880.0	22.6
		9538	1907.6	22.7

HSDPA

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-Set1			
	Power Control Algorithm	Algorithm 2			
	β_c	2/15	12/15	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
HSDPA Specific Settings	MPR (dB)	0	1	1.5	1.5
	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			

For the E-MPR setting, the table below was used referencing from 3GPP TS34.121-1 version 11.1.1 Release 11 specification.

Table 5.2B.5: Maximum Output Powers with HS-DPCCH and E-DCH for test

Sub-test in table C.11.1.3	Power Class 3		Power Class 4	
	Power (dBm)	Tol (dB)	Power (dBm)	Tol (dB)
1	+24	+1.7/-6.7	+21	+2.7/-5.7
2	+22	+3.7/-5.2	+19	+4.7/-4.2
3	+23	+2.7/-5.2	+20	+3.7/-4.2
4	+22	+3.7/-5.2	+19	+4.7/-4.2
5	+24	+1.7/-3.7	+21	+2.7/-2.7

Measured Results

Band	Mode	UL Ch No.	Freq. (MHz)	Avg Pwr (dBm)
W-CDMA Band V	Subtest 1	4132	826.4	21.9
		4183	836.6	21.9
		4233	846.6	21.9
	Subtest 2	4132	826.4	22.0
		4183	836.6	21.9
		4233	846.6	22.0
	Subtest 3	4132	826.4	21.5
		4183	836.6	21.4
		4233	846.6	21.3
	Subtest 4	4132	826.4	21.4
		4183	836.6	21.5
		4233	846.6	21.4
W-CDMA Band II	Subtest 1	9262	1852.4	21.6
		9400	1880.0	21.6
		9538	1907.6	21.7
	Subtest 2	9262	1852.4	21.5
		9400	1880.0	21.5
		9538	1907.6	21.5
	Subtest 3	9262	1852.4	21.0
		9400	1880.0	21.0
		9538	1907.6	21.0
	Subtest 4	9262	1852.4	20.8
		9400	1880.0	20.9
		9538	1907.6	21.0

HSPA (HSDPA & HSUPA)

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	HSPA	HSPA	HSPA	HSPA
	Subtest	1	2	3	4	5
WCDMA General Settings	Loopback Mode	Test Mode 1				
	Rel99 RMC	12.2kbps RMC				
	HSDPA FRC	H-Set1				
	HSUPA Test	HSUPA Loopback				
	Power Control Algorithm	Algorithm2				
	β_c	11/15	6/15	15/15	2/15	15/15
	β_d	15/15	15/15	9/15	15/15	15/15
	β_{ec}	209/225	12/15	30/15	2/15	24/15
	β_c/β_d	11/15	6/15	15/9	2/15	15/15
	β_{hs}	22/15	12/15	30/15	4/15	30/15
	β_{ed}	1309/225	94/75	47/15	56/75	134/15
	CM (dB)	1.0	3.0	2.0	3.0	1.0
	MPR (dB)	0	2	1	2	0
HSDPA Specific Settings	DACK	8				
	DNAK	8				
	DCQI	8				
	Ack-Nack repetition factor	3				
	CQI Feedback (Table 5.2B.4)	4ms				
	CQI Repetition Factor (Table 5.2B.4)	2				
	Ahs = β_{hs}/β_c	30/15				
HSUPA Specific Settings	D E-DPCCH	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	E-TFCI 11 E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO 23 E-TFCI 75 E-TFCI PO 26 E-TFCI 81 E-TFCI PO 27		E-TFCI 11 E-TFCI PO 4 E-TFCI 92 E-TFCI PO 18		E-TFCI 11 E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO 23 E-TFCI 75 E-TFCI PO 26 E-TFCI 81 E-TFCI PO 27

For the E-MPR setting, the table below was used referencing from 3GPP TS34.121-1 version 11.1.1 Release 11 specification.

Table 5.2B.5: Maximum Output Powers with HS-DPCCH and E-DCH for test

Sub-test in table C.11.1.3	Power Class 3		Power Class 4	
	Power (dBm)	Tol (dB)	Power (dBm)	Tol (dB)
1	+24	+1.7/-6.7	+21	+2.7/-5.7
2	+22	+3.7/-5.2	+19	+4.7/-4.2
3	+23	+2.7/-5.2	+20	+3.7/-4.2
4	+22	+3.7/-5.2	+19	+4.7/-4.2
5	+24	+1.7/-3.7	+21	+2.7/-2.7

Measured Results

Band	Mode	UL Ch No.	Freq. (MHz)	Avg Pwr (dBm)
W-CDMA Band V	Subtest 1	4132	826.4	21.4
		4183	836.6	21.5
		4233	846.6	21.6
	Subtest 2	4132	826.4	20.8
		4183	836.6	20.6
		4233	846.6	20.8
	Subtest 3	4132	826.4	20.8
		4183	836.6	20.9
		4233	846.6	20.5
	Subtest 4	4132	826.4	21.4
		4183	836.6	21.3
		4233	846.6	21.2
W-CDMA Band II	Subtest 1	4132	826.4	22.0
		4183	836.6	21.9
		4233	846.6	21.9
	Subtest 2	9262	1852.4	20.9
		9400	1880.0	21.1
		9538	1907.6	21.0
	Subtest 3	9262	1852.4	20.5
		9400	1880.0	20.7
		9538	1907.6	20.6
	Subtest 4	9262	1852.4	20.6
		9400	1880.0	20.7
		9538	1907.6	20.5
	Subtest 5	9262	1852.4	21.1
		9400	1880.0	20.8
		9538	1907.6	21.4

8.3. LTE Band 5

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

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

Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3

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

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

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

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

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

LTE Band 5 Measured Results

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							829 MHz	836.5 MHz	844 MHz
LTE Band 5	10	QPSK	1	0	0	0	23.0	23.0	23.0
			1	25	0	0	22.8	22.9	22.9
			1	49	0	0	22.8	22.9	23.0
			25	0	1	1	22.0	22.0	22.0
			25	12	1	1	22.0	22.0	22.0
			25	25	1	1	22.0	22.0	22.0
			50	0	1	1	21.8	21.9	21.9
		16QAM	1	0	1	1	21.8	21.7	21.4
			1	25	1	1	21.8	21.7	21.2
			1	49	1	1	21.7	21.7	21.3
			25	0	2	2	21.0	21.0	21.0
			25	12	2	2	21.0	21.0	21.0
			25	25	2	2	21.0	21.0	21.0
			50	0	2	2	21.0	21.0	20.9
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	23.0	23.0	23.0
			1	12	0	0	23.0	23.0	23.0
			1	24	0	0	23.0	23.0	23.0
			12	0	1	1	22.0	22.0	22.0
			12	6	1	1	22.0	22.0	22.0
			12	11	1	1	22.0	22.0	22.0
			25	0	1	1	22.0	22.0	22.0
		16QAM	1	0	1	1	22.0	22.0	21.9
			1	12	1	1	22.0	22.0	21.9
			1	24	1	1	21.5	22.0	22.0
			12	0	2	2	21.0	21.0	21.0
			12	6	2	2	21.0	21.0	21.0
			12	11	2	2	21.0	21.0	21.0
			25	0	2	2	21.0	21.0	21.0
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							825.5 MHz	836.5 MHz	847.5 MHz
LTE Band 5	3	QPSK	1	0	0	0	23.0	23.0	22.8
			1	7	0	0	23.0	23.0	22.9
			1	14	0	0	23.0	23.0	22.9
			8	0	1	1	22.0	22.0	22.0
			8	4	1	1	22.0	22.0	22.0
			8	7	1	1	22.0	22.0	22.0
			15	0	1	1	22.0	22.0	22.0
		16QAM	1	0	1	1	22.0	22.0	21.8
			1	7	1	1	21.8	22.0	21.8
			1	14	1	1	21.8	22.0	21.8
			8	0	2	2	21.0	21.0	20.8
			8	4	2	2	21.0	21.0	21.0
			8	7	2	2	21.0	21.0	21.0
			15	0	2	2	21.0	21.0	21.0

LTE Band 5 Measured Results (continued)

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							824.7 MHz	836.5 MHz	848.3 MHz
LTE Band 5	1.4	QPSK	1	0	0	0	23.0	23.0	23.0
			1	2	0	0	23.0	23.0	23.0
			1	5	0	0	23.0	22.9	23.0
			3	0	0	1	23.0	22.9	23.0
			3	1	0	1	23.0	23.0	23.0
			3	2	0	1	23.0	23.0	23.0
			6	0	1	1	22.0	22.0	22.0
		16QAM	1	0	1	1	21.7	21.6	22.0
			1	2	1	1	21.7	21.6	22.0
			1	5	1	1	21.7	21.6	22.0
			3	0	1	2	22.0	22.0	22.0
			3	1	1	2	22.0	22.0	22.0
			3	2	1	2	22.0	22.0	22.0
			6	0	2	2	21.0	21.0	21.0

8.4. Wi-Fi (2.4 GHz Band)

Measured Results

Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	Avg Pwr (dBm)	SAR Test (Yes/No)
2.4 (DTS)	802.11b	1 Mbps	1	2412	15.1	Yes
			6	2437	15.1	
			11	2462	15.0	
	802.11g	6 Mbps	1	2412	13.1	No
			6	2437	13.2	
			11	2462	12.5	
	802.11n (HT20)	MCS0	1	2412	12.2	No
			6	2437	12.4	
			11	2462	12.5	

Note(s):

- Per KDB 248227 D01, SAR is not required for 802.11g/HT20 channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11b channels.

Power measurements to determine worst-case data rates

Mode	Ch #	Freq. (MHz)	Data Rate	Avg Pwr (dBm)	SAR test (Yes/No)
802.11b	6	2437	1 Mbps	15.1	Yes
			2 Mbps	15.0	No
			5.5 Mbps	15.0	No
			11 Mbps	15.0	No

8.5. Wi-Fi (5 GHz Bands)

Measured Results

Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	Avg Pwr (dBm)	SAR Test (Yes/No)
5.2 (UNII)	802.11a	6 Mbps	36	5180	13.2	Yes
			40	5200	12.9	
			44	5220	13.2	
			48	5240	13.2	
	802.11n (HT20)	MCS0	36	5180	11.8	No
			40	5200	12.0	
			48	5240	12.5	
	802.11n (HT40)	MCS0	38	5190	10.8	No
			46	5230	11.5	
5.3 (UNII)	802.11a	6 Mbps	52	5260	13.3	Yes
			56	5280	13.3	
			60	5300	13.1	
			64	5320	13.3	
	802.11n (HT20)	MCS0	52	5260	12.5	No
			60	5300	12.0	
			64	5320	11.5	
	802.11n (HT40)	MCS0	54	5270	11.3	No
			62	5310	10.9	
5.5 (UNII)	802.11a	6 Mbps	100	5500	13.2	Yes
			104	5520	13.5	
			108	5540	13.5	
			112	5560	13.4	
			116	5580	13.4	
			120	5600	13.1	
			124	5620	13.0	
			128	5640	13.4	
			132	5660	13.5	
			136	5680	13.5	
			140	5700	13.5	
	802.11n (HT20)	MCS0	100	5500	12.1	No
			116	5580	12.5	
			140	5700	12.5	
	802.11n (HT40)	MCS0	102	5510	11.2	No
			110	5550	11.3	
			134	5670	11.5	
5.8 (DTS)	802.11a	6 Mbps	149	5745	11.0	Yes
			153	5765	11.0	
			157	5785	11.0	
			161	5805	10.8	
			165	5825	11.0	
	802.11n (HT20)	MCS0	149	5745	11.0	No
			157	5785	11.0	
			161	5805	11.0	
	802.11n (HT40)	MCS0	151	5755	11.0	No
			159	5795	11.0	

Note(s):

Per KDB 248227, SAR is not required for 802.11n HT20/HT40 channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11a channels.

Power measurements to determine worst-case data rates

Band	Mode	Ch #	Freq. (MHz)	Data Rate	Avg Pwr (dBm)	SAR test (Yes/No)
5.2 GHz (UNII)	802.11a	48	5240	6 Mbps	13.4	Yes
				9 Mbps	12.8	No
				12 Mbps	12.8	No
				18 Mbps	12.8	No
				24 Mbps	12.8	No
				36 Mbps	12.8	No
				48 Mbps	12.6	No
5.3 GHz (UNII)	802.11a	64	5320	54 Mbps	12.6	No
				6 Mbps	13.5	Yes
				9 Mbps	13.5	No
				12 Mbps	13.4	No
				18 Mbps	13.4	No
				24 Mbps	13.3	No
				36 Mbps	13.4	No
5.5 GHz (UNII)	802.11a	108	5540	48 Mbps	13.4	No
				54 Mbps	13.4	No
				6 Mbps	13.5	Yes
				9 Mbps	13.5	No
				12 Mbps	13.0	No
				18 Mbps	13.0	No
				24 Mbps	13.2	No
5.8 GHz (DTS)	802.11a	157	5785	36 Mbps	13.0	No
				48 Mbps	13.0	No
				54 Mbps	13.0	No
				6 Mbps	11.0	Yes
				9 Mbps	11.0	No
				12 Mbps	11.0	No
				18 Mbps	11.0	No
				24 Mbps	11.0	No
				36 Mbps	11.0	No
				48 Mbps	10.9	No
				54 Mbps	10.9	No

8.6. Bluetooth

Maximum tune-up tolerance limit is 12.5 dBm from the rated nominal maximum output power. This power level qualifies for exclusion of SAR testing.

9. 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.

9.1. Tissue Dielectric Parameters

FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

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

IEEE Std 1528-2013

Refer to Table 3 within the IEEE Std 1528-2013

9.2. Dielectric Property Measurements Results

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.

SAR Lab G

Date Tested	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit $\pm$ (%)
9/29/2014	Head 835	e'	41.0400	Relative Permittivity (ϵ_r):	41.04	41.50	-1.11	5
		e"	19.8600	Conductivity (σ):	0.92	0.90	2.45	5
	Head 820	e'	41.2500	Relative Permittivity (ϵ_r):	41.25	41.60	-0.85	5
		e"	19.9400	Conductivity (σ):	0.91	0.90	1.19	5
	Head 850	e'	40.8700	Relative Permittivity (ϵ_r):	40.87	41.50	-1.52	5
		e"	19.8100	Conductivity (σ):	0.94	0.92	2.32	5
9/29/2014	Body 835	e'	52.6500	Relative Permittivity (ϵ_r):	52.65	55.20	-4.62	5
		e"	21.8500	Conductivity (σ):	1.01	0.97	4.58	5
	Body 820	e'	52.8300	Relative Permittivity (ϵ_r):	52.83	55.28	-4.43	5
		e"	21.9000	Conductivity (σ):	1.00	0.97	3.10	5
	Body 850	e'	52.4900	Relative Permittivity (ϵ_r):	52.49	55.16	-4.84	5
		e"	21.7900	Conductivity (σ):	1.03	0.99	4.33	5

SAR Lab H

Date Tested	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit $\pm$ (%)
9/29/2014	Head 1900	e'	39.3000	Relative Permittivity (ϵ_r):	39.30	40.00	-1.75	5
		e"	13.5500	Conductivity (σ):	1.43	1.40	2.25	5
	Head 1850	e'	39.4900	Relative Permittivity (ϵ_r):	39.49	40.00	-1.28	5
		e"	13.5100	Conductivity (σ):	1.39	1.40	-0.73	5
	Head 1910	e'	39.2700	Relative Permittivity (ϵ_r):	39.27	40.00	-1.82	5
		e"	13.5700	Conductivity (σ):	1.44	1.40	2.94	5
9/29/214	Body 1900	e'	51.0700	Relative Permittivity (ϵ_r):	51.07	53.30	-4.18	5
		e"	14.9000	Conductivity (σ):	1.57	1.52	3.56	5
	Body 1850	e'	51.2000	Relative Permittivity (ϵ_r):	51.20	53.30	-3.94	5
		e"	14.9100	Conductivity (σ):	1.53	1.52	0.90	5
	Body 1910	e'	51.0500	Relative Permittivity (ϵ_r):	51.05	53.30	-4.22	5
		e"	14.9000	Conductivity (σ):	1.58	1.52	4.11	5

SAR Lab 1

Date Tested	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit $\pm$ (%)
10/6/2014	Head 2450	e'	37.3100	Relative Permittivity (ϵ_r):	37.31	39.20	-4.82	5
		e"	12.7500	Conductivity (σ):	1.74	1.80	-3.51	5
	Head 2410	e'	37.5100	Relative Permittivity (ϵ_r):	37.51	39.28	-4.50	5
		e"	12.5900	Conductivity (σ):	1.69	1.76	-4.17	5
	Head 2475	e'	37.2400	Relative Permittivity (ϵ_r):	37.24	39.17	-4.92	5
		e"	12.8000	Conductivity (σ):	1.76	1.83	-3.59	5
10/6/2014	Body 2450	e'	50.4200	Relative Permittivity (ϵ_r):	50.42	52.70	-4.33	5
		e"	14.7700	Conductivity (σ):	2.01	1.95	3.18	5
	Body 2410	e'	50.5600	Relative Permittivity (ϵ_r):	50.56	52.76	-4.17	5
		e"	14.6200	Conductivity (σ):	1.96	1.91	2.71	5
	Body 2475	e'	50.3400	Relative Permittivity (ϵ_r):	50.34	52.67	-4.42	5
		e"	14.8700	Conductivity (σ):	2.05	1.99	3.08	5

SAR Lab 5

Date Tested	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
10/7/2014	Head 5180	e'	37.0200	Relative Permittivity (ε _r):	37.02	36.01	2.80	5
		e"	15.3200	Conductivity (σ):	4.41	4.63	-4.71	5
	Head 5200	e'	36.9200	Relative Permittivity (ε _r):	36.92	35.99	2.58	5
		e"	15.3000	Conductivity (σ):	4.42	4.65	-4.88	5
	Head 5600	e'	36.4700	Relative Permittivity (ε _r):	36.47	35.53	2.63	5
		e"	15.4700	Conductivity (σ):	4.82	5.06	-4.81	5
	Head 5800	e'	36.1800	Relative Permittivity (ε _r):	36.18	35.30	2.49	5
		e"	15.6600	Conductivity (σ):	5.05	5.27	-4.17	5
	Head 5825	e'	36.0600	Relative Permittivity (ε _r):	36.06	35.30	2.15	5
	e"	15.7500	Conductivity (σ):	5.10	5.27	-3.20	5	
10/6/2014	Body 5180	e'	48.0700	Relative Permittivity (ε _r):	48.07	49.05	-1.99	5
		e"	18.6700	Conductivity (σ):	5.38	5.27	2.01	5
	Body 5200	e'	48.1300	Relative Permittivity (ε _r):	48.13	49.02	-1.81	5
		e"	18.7200	Conductivity (σ):	5.41	5.29	2.23	5
	Body 5600	e'	47.4000	Relative Permittivity (ε _r):	47.40	48.48	-2.22	5
		e"	19.2800	Conductivity (σ):	6.00	5.76	4.21	5
	Body 5800	e'	47.1000	Relative Permittivity (ε _r):	47.10	48.20	-2.28	5
		e"	19.3000	Conductivity (σ):	6.22	6.00	3.74	5
	Body 5825	e'	47.0500	Relative Permittivity (ε _r):	47.05	48.20	-2.39	5
	e"	19.3200	Conductivity (σ):	6.26	6.00	4.29	5	

10. 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 remeasured or sooner when marginal liquid parameters are used at the beginning of a series of measurements.

10.1. Reference Target SAR Values

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

System Dipole	Serial No.	Cal. Date	Freq. (MHz)	Target SAR Values (W/kg)		
				1g/10g	Head	Body
D835V2	4d002	11/15/2013	850	1g	9.49	9.43
				10g	6.18	6.21
D1900V2	5d140	4/23/2014	1900	1g	40.1	40.2
				10g	21.0	21.3
D2450V2	706	5/20/2014	2450	1g	53.0	50.2
				10g	24.5	23.4
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

10.2. 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 G

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			
9/29/2014	D835V2	4d002	Head	1g	0.964	9.64	9.49	1.58
				10g	0.630	6.30	6.18	1.94
9/29/2014	D835V2	4d002	Body	1g	0.961	9.61	9.4	1.91
				10g	0.633	6.33	6.2	1.93

SAR Lab H

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			
9/29/2014	D1900V2	5d140	Head	1g	3.80	38.0	40.1	-5.24
				10g	1.96	19.6	21.0	-6.67
9/29/2014	D1900V2	5d140	Body	1g	3.92	39.2	40.2	-2.49
				10g	2.03	20.3	21.3	-4.69

SAR Lab 1

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			
10/6/2014	D2450V2	706	Head	1g	4.95	49.5	53.0	-6.60
				10g	2.25	22.5	24.5	-8.16
10/6/2014	D2450V2	706	Body	1g	5.37	53.7	50.2	6.97
				10g	2.49	24.9	23.4	6.41

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			
10/7/2014	D5GHzV2 (5.2GHz)	1003	Head	1g	7.62	76.2	77.7	-1.93
				10g	2.20	22.0	22.2	-0.90
10/7/2014	D5GHzV2 (5.6GHz)	1003	Head	1g	7.87	78.7	81.8	-3.79
				10g	2.23	22.3	23.2	-3.88
10/7/2014	D5GHzV2 (5.8GHz)	1003	Head	1g	7.56	75.6	78.3	-3.45
				10g	2.15	21.5	22.1	-2.71
10/7/2014	D5GHzV2 (5.2GHz)	1003	Body	1g	7.89	78.9	73.5	7.35
				10g	2.23	22.3	20.5	8.78
10/7/2014	D5GHzV2 (5.6GHz)	1003	Body	1g	8.33	83.3	79.6	4.65
				10g	2.32	23.2	22.1	4.98
10/7/2014	D5GHzV2 (5.8GHz)	1003	Body	1g	7.52	75.2	73.8	1.90
				10g	2.10	21.0	20.4	2.94

11. 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:

Body SAR is also measured for HSPA when the maximum average output of each RF channel with HSPA active is at least $\frac{1}{4}$ dB higher than that measured without HSPA using 12.2 kbps RMC or the maximum SAR for 12.2 kbps RMC is above 75% of the SAR limit. Body SAR for HSPA is measured with E-DCH Sub-test 5, using H-Set 1 and QPSK for FRC and a 12.2 kbps RMC configured in Test Loop Mode 1 with power control algorithm 2.

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.

11.1. GSM850

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled	
Head	Voice	0	Left Touch	190	836.6	33.5	33.2	0.200	0.214	0.161	0.173	
			Left Tilt	190	836.6	33.5	33.2	0.144	0.154	0.114	0.122	
			Right Touch	190	836.6	33.5	33.2	0.224	0.240	0.176	0.189	1
			Right Tilt	190	836.6	33.5	33.2	0.149	0.160	0.116	0.124	
Head VoIP	GPRS 1 Slot	0	Left Touch	190	836.6	33.5	33.2	0.188	0.201	0.151	0.162	
			Left Tilt	190	836.6	33.5	33.2	0.136	0.146	0.107	0.115	
			Right Touch	190	836.6	33.5	33.2	0.214	0.229	0.170	0.182	2
			Right Tilt	190	836.6	33.5	33.2	0.150	0.161	0.117	0.125	
Body-worn	Voice	10	Rear	190	836.6	33.5	33.2	0.401	0.430	0.264	0.283	3
			Front	190	836.6	33.5	33.2	0.307	0.329	0.208	0.223	
Body-worn(VoIP) & Hotspot	GPRS 1 Slot	10	Rear	190	836.6	33.5	33.2	0.351	0.376	0.252	0.270	4
Front			190	836.6	33.5	33.2	0.271	0.290	0.200	0.214		
Hotspot			Edge 3	190	836.6	33.5	33.2	0.156	0.167	0.081	0.087	
	Edge 4		190	836.6	33.5	33.2	0.168	0.180	0.114	0.122		

11.2. GSM1900

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled	
Head	Voice	0	Left Touch	661	1880.0	30.5	30.0	0.206	0.231	0.126	0.141	5
			Left Tilt	661	1880.0	30.5	30.0	0.056	0.063	0.033	0.037	
			Right Touch	661	1880.0	30.5	30.0	0.161	0.181	0.097	0.109	
			Right Tilt	661	1880.0	30.5	30.0	0.062	0.069	0.031	0.034	
Head VoIP	GPRS 1 Slot	0	Left Touch	661	1880.0	30.5	30.0	0.191	0.214	0.117	0.131	6
			Left Tilt	661	1880.0	30.5	30.0	0.037	0.042	0.025	0.028	
			Right Touch	661	1880.0	30.5	30.0	0.153	0.172	0.091	0.102	
			Right Tilt	661	1880.0	30.5	30.0	0.058	0.065	0.030	0.033	
Body-worn	Voice	10	Rear	661	1880.0	30.5	30.0	0.484	0.543	0.286	0.321	
			Front	661	1880.0	30.5	30.0	0.508	0.570	0.304	0.341	7
Body-worn(VoIP) & Hotspot	GPRS 1 Slot	10	Rear	661	1880.0	30.5	30.0	0.443	0.497	0.262	0.294	
Front			661	1880.0	30.5	30.0	0.479	0.537	0.287	0.322		
Hotspot			Edge 3	661	1880.0	30.5	30.0	0.615	0.690	0.341	0.383	8
	Edge 4		661	1880.0	30.5	30.0	0.169	0.190	0.094	0.105		

11.3. W-CDMA Band V

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled	
Head	Rel 99 RMC	0	Left Touch	4183	836.6	23.0	22.9	0.152	0.156	0.112	0.115	9
			Left Tilt	4183	836.6	23.0	22.9	0.114	0.117	0.089	0.091	
			Right Touch	4183	836.6	23.0	22.9	0.176	0.180	0.138	0.141	
			Right Tilt	4183	836.6	23.0	22.9	0.121	0.124	0.095	0.097	
Body-worn & Htpspot	Rel 99 RMC	10	Rear	4183	836.6	23.0	22.9	0.289	0.296	0.191	0.195	10
			Front	4183	836.6	23.0	22.9	0.235	0.240	0.184	0.188	
Hotspot	Rel 99 RMC	10	Edge 3	4183	836.6	23.0	22.9	0.140	0.143	0.073	0.075	
			Edge 4	4183	836.6	23.0	22.9	0.143	0.146	0.098	0.101	

11.4. W-CDMA Band II

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled	
Head	Rel 99 RMC	0	Left Touch	9400	1880.0	23.0	22.6	0.339	0.372	0.208	0.228	11
			Left Tilt	9400	1880.0	23.0	22.6	0.132	0.145	0.079	0.087	
			Right Touch	9400	1880.0	23.0	22.6	0.249	0.273	0.150	0.164	
			Right Tilt	9400	1880.0	23.0	22.6	0.094	0.103	0.058	0.063	
Body-worn & Hotspot	Rel 99 RMC	10	Rear	9262	1852.4	23.0	22.6	0.662	0.726	0.393	0.431	
				9400	1880.0	23.0	22.6	0.738	0.809	0.436	0.478	
				9538	1907.6	23.0	22.7	0.815	0.873	0.476	0.510	
			Front	9262	1852.4	23.0	22.6	0.636	0.697	0.385	0.422	
				9400	1880.0	23.0	22.6	0.744	0.816	0.447	0.490	
				9538	1907.6	23.0	22.7	0.874	0.937	0.518	0.555	
Hotspot	Rel 99 RMC	10	Edge 3	9262	1852.4	23.0	22.6	0.972	1.066	0.544	0.596	13
				9400	1880.0	23.0	22.6	0.949	1.041	0.590	0.647	
				9538	1907.6	23.0	22.7	0.907	0.972	0.505	0.541	
			Edge 4	9400	1880.0	23.0	22.6	0.292	0.320	0.165	0.181	

11.5. 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)		10-g SAR (W/kg)		Plot No.
								Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled	
Head	QPSK	0	Left Touch	20525	836.5	1	0	23.0	23.0	0.147	0.147	0.118	0.118	14
						25	0	22.0	22.0	0.119	0.119	0.096	0.096	
			Left Tilt	20525	836.5	1	0	23.0	23.0	0.123	0.123	0.096	0.096	
						25	0	22.0	22.0	0.099	0.099	0.078	0.078	
			Right Touch	20525	836.5	1	0	23.0	23.0	0.181	0.181	0.142	0.142	
						25	0	22.0	22.0	0.148	0.148	0.116	0.116	
Body-worn & Hotspot	QPSK	10	Rear	20525	836.5	1	0	23.0	23.0	0.266	0.266	0.194	0.194	15
						25	0	22.0	22.0	0.216	0.216	0.156	0.156	
			Front	20525	836.5	1	0	23.0	23.0	0.238	0.238	0.188	0.188	
						25	0	22.0	22.0	0.192	0.192	0.152	0.152	
			Edge 3	20525	836.5	1	0	23.0	23.0	0.114	0.114	0.060	0.060	
						25	0	22.0	22.0	0.094	0.094	0.049	0.049	
Hotspot	QPSK	10	Edge 4	20525	836.5	1	0	23.0	23.0	0.154	0.154	0.105	0.105	
						25	0	22.0	22.0	0.126	0.126	0.086	0.086	

11.6. Wi-Fi (DTS Band)

Freq. Band	RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
							Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled	
2.4 GHz	Head	802.11b 1 Mbps	0	Left Touch	6	2437.0	15.5	15.1	0.014	0.015	0.006	0.006	16
				Left Tilt	6	2437.0	15.5	15.1	0.010	0.011	0.004	0.004	
				Right Touch	6	2437.0	15.5	15.1	0.008	0.008	0.003	0.003	
				Right Tilt	6	2437.0	15.5	15.1	0.005	0.006	0.002	0.002	
	Body-worn & Hotspot	802.11b 1 Mbps	10	Rear	6	2437.0	15.5	15.1	<0.001	<0.001	<0.001	<0.001	17
				Front	6	2437.0	15.5	15.1	<0.001	<0.001	<0.001	<0.001	
	Hotspot	802.11b 1 Mbps	10	Edge 1	6	2437.0	15.5	15.1	<0.001	<0.001	<0.001	<0.001	
				Edge 2	6	2437.0	15.5	15.1	<0.001	<0.001	<0.001	<0.001	
Freq. Band	RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
							Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled	
5.8 GHz	Head	802.11a 6 Mbps	0	Left Touch	149	5745.0	11.5	11.0	<0.001	<0.001	<0.001	<0.001	18
				Left Tilt	149	5745.0	11.5	11.0	<0.001	<0.001	<0.001	<0.001	
				Right Touch	149	5745.0	11.5	11.0	<0.001	<0.001	<0.001	<0.001	
				Right Tilt	149	5745.0	11.5	11.0	<0.001	<0.001	<0.001	<0.001	
	Body-worn & Wi-Fi Direct	802.11a 6 Mbps	10	Rear	149	5745.0	11.5	11.0	<0.001	<0.001	<0.001	<0.001	19
				Front	149	5745.0	11.5	11.0	<0.001	<0.001	<0.001	<0.001	
	Wi-Fi Direct	802.11a 6 Mbps	10	Edge 1	149	5745.0	11.5	11.0	<0.001	<0.001	<0.001	<0.001	
				Edge 2	149	5745.0	11.5	11.0	<0.001	<0.001	<0.001	<0.001	

11.7. Wi-Fi (UNII Band)

Freq. Band	RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
							Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled	
5.2 GHz	Head	802.11a 6 Mbps	0	Left Touch	36	5180.0	13.5	13.2	0.383	0.410	0.092	0.099	20
				Left Tilt	36	5180.0	13.5	13.2	0.229	0.245	0.054	0.057	
				Right Touch	36	5180.0	13.5	13.2	0.127	0.136	0.033	0.036	
				Right Tilt	36	5180.0	13.5	13.2	0.079	0.085	0.019	0.020	
	Body-worn	802.11a 6 Mbps	10	Rear	36	5180.0	13.5	13.2	0.023	0.025	0.007	0.007	21
				Front	36	5180.0	13.5	13.2	0.019	0.020	0.005	0.006	
	Wi-Fi Direct	802.11a 6 Mbps	10	Edge 1	36	5180.0	13.5	13.2	<0.001	<0.001	<0.001	<0.001	
				Edge 2	36	5180.0	13.5	13.2	<0.001	<0.001	<0.001	<0.001	
Freq. Band	RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
							Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled	
5.3 GHz	Head	802.11a 6 Mbps	0	Left Touch	52	5260.0	13.5	13.3	0.122	0.128	0.025	0.027	22
				Left Tilt	52	5260.0	13.5	13.3	0.069	0.072	0.014	0.014	
				Right Touch	52	5260.0	13.5	13.3	0.045	0.047	0.009	0.010	
				Right Tilt	52	5260.0	13.5	13.3	0.045	0.047	0.001	0.001	
	Body-worn	802.11a 6 Mbps	10	Rear	52	5260.0	13.5	13.3	<0.001	<0.001	<0.001	<0.001	23
				Front	52	5260.0	13.5	13.3	<0.001	<0.001	<0.001	<0.001	
Freq. Band	RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
							Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled	
5.5 GHz	Head	802.11a 6 Mbps	0	Left Touch	104	5520.0	13.5	13.5	0.062	0.062	0.013	0.013	24
				Left Tilt	104	5520.0	13.5	13.5	0.042	0.042	0.008	0.008	
				Right Touch	104	5520.0	13.5	13.5	0.028	0.028	0.006	0.006	
				Right Tilt	104	5520.0	13.5	13.5	0.027	0.027	0.005	0.005	
	Body-worn	802.11a 6 Mbps	10	Rear	104	5520.0	13.5	13.5	<0.001	<0.001	<0.001	<0.001	25
				Front	104	5520.0	13.5	13.5	<0.001	<0.001	<0.001	<0.001	

11.8. Bluetooth

11.8.1. Standalone SAR Test Exclusion Considerations

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.

Body-worn Accessory Exposure Conditions

Max. tune-up tolerance limit		Min. test separation distance (mm)	Frequency (GHz)	Result
(dBm)	(mW)			
12.5	18	10	2.480	2.8

Conclusion:

The computed value is < 3 ; therefore, Bluetooth qualifies for Standalone SAR test exclusion.

11.8.2. Estimated SAR

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:

- $(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm}) \cdot [\sqrt{f_{(\text{GHz})}}/x]$ 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.

Estimated SAR Result for Body-worn Accessory Conditions:

Test Configuration	Max. tune-up tolerance limit (mW)	Min. test separation distance (mm)	Frequency (GHz)	Estimated 1-g SAR (W/kg)
Rear/Front	18	10	2.480	0.378

12. SAR Measurement Variability

In accordance with published RF Exposure KDB procedure 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 .

12.1. The Highest Measured SAR Configuration in Each Frequency Band

Frequency Band (MHz)	Air Interface	Head (W/kg)	Body-worn Accessory (W/kg)	Wireless Router (Hotspot) (W/kg)
850	GSM 850	N/A	N/A	N/A
	WCDMA Band V	N/A	N/A	N/A
	LTE Band 5	N/A	N/A	N/A
1900	GSM 1900	N/A	N/A	N/A
	WCDMA Band II	N/A	N/A	0.972
2400	Wi-Fi 802.11b/g/n	N/A	N/A	N/A
5200	Wi-Fi 802.11a/n/ac	N/A	N/A	N/A
5300	Wi-Fi 802.11a/n/ac	N/A	N/A	N/A
5500	Wi-Fi 802.11a/n/ac	N/A	N/A	N/A
5800	Wi-Fi 802.11a/n/ac	N/A	N/A	N/A

12.2. Repeated Measurement Results

Head

N/A

Body-worn Accessory

N/A

Wireless Router (Hotspot)

Frequency band	Test Position	Mode	Ch #.	Freq. (MHz)	Meas. SAR (W/kg)		Largest to Smallest SAR Ratio	Note
					Original	Repeated		
W-CDMA Band II	Edge 3	Rel. 99 RMC	9262	1852.4	0.972	0.925	1.05	1

Note(s):

1. 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 .

13. Simultaneous Transmission SAR Analysis

KDB 447498 D01 General RF Exposure Guidance v05, introduces a new formula for calculating the SAR to Peak Location Ratio (SPLSR) between pairs of simultaneously transmitting antennas:

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

Where:

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

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

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

A new threshold of 0.04 is also introduced in the draft KDB. Thus, in order for a pair of simultaneous transmitting antennas with the sum of 1-g SAR > 1.6 W/kg to qualify for exemption from Simultaneous Transmission SAR measurements, it has to satisfy the condition of:

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

13.1. 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	0.214	0.015		0.229	No
		① + ③	0.214	0.410		0.624	No
	Left Tilt	① + ②	0.154	0.011		0.165	No
		① + ③	0.154	0.245		0.399	No
	Right Touch	① + ②	0.240	0.008		0.248	No
		① + ③	0.240	0.136		0.376	No
	Right Tilt	① + ②	0.161	0.006		0.167	No
		① + ③	0.161	0.085		0.246	No
Body-worn Accessory & Hotspot	Rear	① + ②	0.430	<0.001		0.430	No
		① + ③	0.430	0.025		0.455	No
		① + ④	0.430		0.378	0.808	No
	Front	① + ②	0.329	<0.001		0.329	No
		① + ③	0.329	0.020		0.349	No
		① + ④	0.329		0.378	0.707	No

SAR to Peak Location Separation Ratio (SPLSR)

As the Sum of the SAR is not greater than 1.6 W/kg SPLSR assessment is not required.

13.2. 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	0.231	0.015		0.246	No
		① + ③	0.231	0.410		0.641	No
	Left Tilt	① + ②	0.063	0.011		0.074	No
		① + ③	0.063	0.245		0.308	No
	Right Touch	① + ②	0.181	0.008		0.189	No
		① + ③	0.181	0.136		0.317	No
	Right Tilt	① + ②	0.069	0.006		0.075	No
		① + ③	0.069	0.085		0.154	No
Body-worn Accessory & Hotspot	Rear	① + ②	0.543	<0.001		0.543	No
		① + ③	0.543	0.025		0.568	No
		① + ④	0.543		0.378	0.921	No
	Front	① + ②	0.570	<0.001		0.570	No
		① + ③	0.570	0.020		0.590	No
		① + ④	0.570		0.378	0.948	No

SAR to Peak Location Separation Ratio (SPLSR)

As the Sum of the SAR is not greater than 1.6 W/kg SPLSR assessment is not required.

13.3. 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 WCDMA V	② Wi-Fi(DTS)	③ Wi-Fi(UNII)	④ Bluetooth		
Head	Left Touch	① + ②	0.156	0.015			0.171	No
		① + ③	0.156		0.410		0.566	No
	Left Tilt	① + ②	0.117	0.011			0.128	No
		① + ③	0.117		0.245		0.362	No
	Right Touch	① + ②	0.180	0.008			0.188	No
		① + ③	0.180		0.136		0.316	No
	Right Tilt	① + ②	0.124	0.006			0.130	No
		① + ③	0.124		0.085		0.209	No
Body-worn Accessory & Hotspot	Rear	① + ②	0.296	<0.001			0.296	No
		① + ③	0.296		0.025		0.321	No
		① + ④	0.296			0.378	0.674	No
	Front	① + ②	0.240	<0.001			0.240	No
		① + ③	0.240		0.020		0.260	No
		① + ④	0.240			0.378	0.618	No

SAR to Peak Location Separation Ratio (SPLSR)

As the Sum of the SAR is not greater than 1.6 W/kg SPLSR assessment is not required.

13.4. 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 WCDMA II	② Wi-Fi(DTS)	③ Wi-Fi(UNII)	④ Bluetooth		
Head	Left Touch	① + ②	0.372	0.015			0.387	No
		① + ③	0.372		0.410		0.782	No
	Left Tilt	① + ②	0.145	0.011			0.156	No
		① + ③	0.145		0.245		0.390	No
	Right Touch	① + ②	0.273	0.008			0.281	No
		① + ③	0.273		0.136		0.409	No
	Right Tilt	① + ②	0.103	0.006			0.109	No
		① + ③	0.103		0.085		0.188	No
Body-worn Accessory & Hotspot	Rear	① + ②	0.873	<0.001			0.873	No
		① + ③	0.873		0.025		0.898	No
		① + ④	0.873			0.378	1.251	No
	Front	① + ②	0.937	<0.001			0.937	No
		① + ③	0.937		0.020		0.957	No
		① + ④	0.937			0.378	1.315	No

SAR to Peak Location Separation Ratio (SPLSR)

As the Sum of the SAR is not greater than 1.6 W/kg SPLSR assessment is not required.

13.5. 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	0.147	0.015			0.162	No
		① + ③	0.147		0.410		0.557	No
	Left Tilt	① + ②	0.123	0.011			0.134	No
		① + ③	0.123		0.245		0.368	No
	Right Touch	① + ②	0.181	0.008			0.189	No
		① + ③	0.181		0.136		0.317	No
	Right Tilt	① + ②	0.139	0.006			0.145	No
		① + ③	0.139		0.085		0.224	No
Body-worn Accessory & Hotspot	Rear	① + ②	0.266	<0.001			0.266	No
		① + ③	0.266		0.025		0.291	No
		① + ④	0.266			0.378	0.644	No
	Front	① + ②	0.238	<0.001			0.238	No
		① + ③	0.238		0.020		0.258	No
		① + ④	0.238			0.378	0.616	No

SAR to Peak Location Separation Ratio (SPLSR)

As the Sum of the SAR is not greater than 1.6 W/kg SPLSR assessment is not required.

14. Appendixes

Refer to separated files for the following appendixes.

- 14.1. Photos and Antenna Locations
- 14.2. System Performance Check Plots
- 14.3. Highest SAR Test Plots
- 14.4. Tissue Material Ingredients
- 14.5. Calibration Certificate for E-Field Probe EX3DV4 - SN 3686
- 14.6. Calibration Certificate for E-Field Probe EX3DV4 - SN 3990
- 14.7. Calibration Certificate for E-Field Probe EX3DV4 - SN 3991
- 14.8. Calibration Certificate for E-Field Probe EX3DV4 - SN 3902
- 14.9. Calibration Certificate for D835V2 - SN 4d002
- 14.10. Calibration Certificate for D1900V2 - SN 5d140
- 14.11. Calibration Certificate for D2450V2 - SN 706
- 14.12. Calibration Certificate for D5GHzV2 - SN 1003

END OF REPORT