



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-A700S, SM-A700K, SM-A700L
FCC ID: A3LSMA700KOR**

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Prepared for

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NVLAP LAB CODE 200065-0

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--	12/10/2014	Initial Issue	--

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1. Attestation of Test Results

Applicant Name	SAMSUNG ELECTRONICS CO., LTD.			
FCC ID	A3LSMA700KOR			
Model Name	GSM/WCDMA/LTE Phone + Bluetooth, DTS/UNII a/b/g/n, ANT+ & NFC			
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)		Extremities (hands, wrists, ankles, etc.) (10g of tissue)	
General population/Uncontrolled exposure	1.6		4	
The Highest Reported SAR (W/kg)				
RF Exposure Conditions		Equipment Class		
		Licensed	DTS	U-NII
Head		0.096	0.977	1.090
Body-worn*		0.445	0.221	0.241
Hotspot/Wi-Fi Direct		0.707	0.420	N/A
Simultaneous Transmission	Head	1.186	1.070	1.186
	Body-worn*	0.686	0.666	0.686
	Hotspot/ Wi-Fi Direct	0.097	0.097	N/A
*Note: The Body-worn minimum separation distance is 15 mm. To cover both body-worn and hotspot RF exposure conditions testing was performed at a separation distance of 10 mm.				
Date Tested	11/24/2014 - 12/5/2014			
Test Results	Pass			
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.		Anthony Cerezo 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, and TCB workshop updates:

- 447498 D01 General RF Exposure Guidance v05r02
- 648474 D04 Handset SAR v01r02
- 941225 D01 SAR 3G SAR Procedures v03
- 941225 D05 SAR for LTE Devices v02r03
- 941225 D06 Hotspot Mode SAR v02
- 248227 D01 SAR Meas for IEEE 802.11 Transmitters DR01-41733I
- 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r03
- 865664 D02 SAR RF Exposure 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

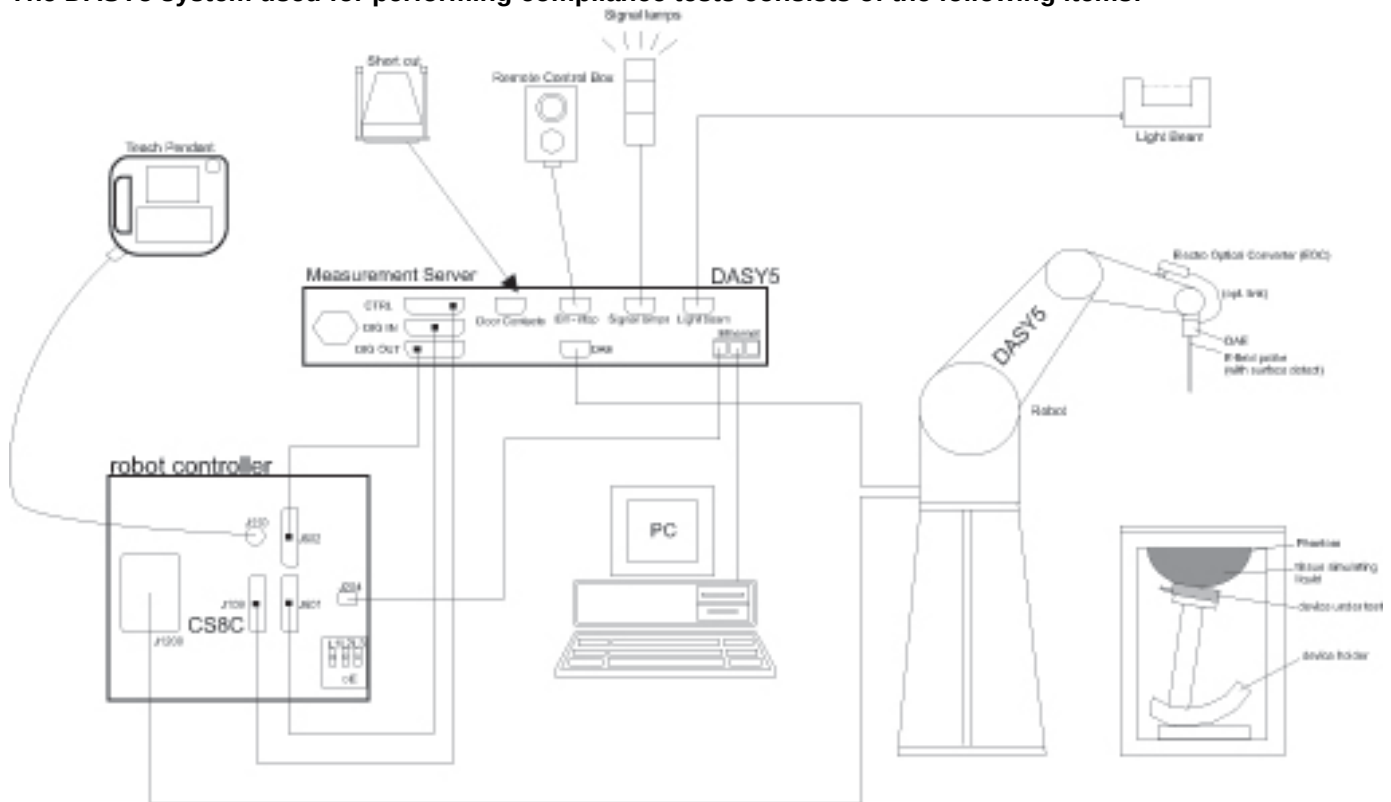
47173 Benicia Street	47266 Benicia Street
SAR Lab A	SAR Lab 1
SAR Lab B	SAR Lab 2
SAR Lab C	SAR Lab 3
SAR Lab D	SAR Lab 4
SAR Lab E	SAR Lab 5
SAR Lab F	
SAR Lab G	
SAR Lab H	

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	Control Company	4242	122529162	10/8/2015

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	HP	437B	3125U11364	8/27/2015
Power Meter	HP	437B	3125U12345	8/15/2015
Power Sensor	HP	8481A	2702A76223	9/17/2015
Power Sensor	HP	8481A	1926A27048	8/15/2015
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
E-Field Probe	SPEAG	EX3DV4	3772	2/26/2015
E-Field Probe	SPEAG	EX3DV4	3749	1/29/2015
Data Acquisition Electronics	SPEAG	DAE4	1259	1/23/2015
Data Acquisition Electronics	SPEAG	DAE4	500	5/15/2015
System Validation Dipole	SPEAG	D750V2	1024	5/16/2015
System Validation Dipole	SPEAG	D835V2	4d117	5/16/2015
System Validation Dipole	SPEAG	D1900V2	5d163	9/11/2015
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	134855-bw	7/15/2015
Base Station Simulator	R & S	CMW500	134853-ud	7/17/2015
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 1528-2013 is not required in SAR reports submitted for equipment approval.

6. Device Under Test (DUT) Information

6.1. DUT Description

Model: SM-A700S, SM-A700K, SM-A700L	
Device Dimension	Overall (Length x Width): 150 mm x 75 mm Overall Diagonal: 165 mm Display Diagonal: 140 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 5.8 GHz)
Wi-Fi Direct	Wi-Fi Direct enabled devices transfer data directly between each other ☒ Wi-Fi Direct (Wi-Fi 2.4 GHz) ☒ Wi-Fi Direct (Wi-Fi 5.8 GHz)

6.2. Wireless Technologies

Wireless technologies	Frequency bands	Operating mode	Duty Cycle used for SAR testing
GSM	1900	Voice (GMSK) GPRS (GMSK)	GSM Voice: 12.5%; GPRS: 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 supported		
W-CDMA (UMTS)	Band V and II	UMTS Rel. 99 (Voice & Data) HSDPA (Rel. 7, CAT 5) HSUPA (Rel. 6, CAT 6)	100%
LTE (FDD)	Band 5 and 17	QPSK, 16QAM (Rel. 10) Does not support Carrier Aggregation (CA).	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 1.2 Version 2.0 + EDR Version 2.1 + EDR Version 3.0 + HS Version 4.0 LE	N/A

6.3. Nominal and Maximum Output Power

Upper limit (dB): -1.5 ~ 0.5		RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit
GSM1900	Voice	29.5	30.0
	GPRS 1 slot	29.5	30.0
	GPRS 2 slots	27.0	27.5
	GPRS 3 slots	26.0	26.5
	GPRS 4 slots	24.0	24.5
W-CDMA Band V	R99	22.5	23.0
	HSDPA	21.0	21.5
	HSUPA	21.0	21.5
W-CDMA Band II	R99	22.5	23.0
	HSDPA	21.0	21.5
	HSUPA	21.0	21.5
LTE Band 5	QPSK	23.0	23.5
LTE Band 17	QPSK	23.0	23.5

Upper limit (dB): ~ 0.5		RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit
Wi-Fi 2.4 GHz	802.11b	17.0	17.5
	802.11g	14.0	14.5
	802.11n HT20	12.0	12.5
Wi-Fi 5 GHz	802.11a	12.0	12.5
	802.11n HT20	12.0	12.5
	802.11n HT40	12.0	12.5
Bluetooth		10.5	11.0
Bluetooth LE		0.5	1.0

6.4. Simultaneous Transmission Condition

RF Exposure Condition	Capable Transmit Configurations
Head	1. GSM1900 Voice + Wi-Fi 2.4/5GHz 2. GSM1900 (GPRS) + Wi-Fi 2.4/5GHz 3. W-CDMA Band V / II + Wi-Fi 2.4/5GHz 4. LTE B5/17 + Wi-Fi 2.4/5GHz
Body-worn Accessory	1. GSM1900 Voice + Wi-Fi 2.4/5GHz 2. GSM1900 Voice + BT 3. GSM1900 (GPRS) + Wi-Fi 2.4/5GHz 4. GSM1900 (GPRS) + BT 5. W-CDMA Band V / II + Wi-Fi 2.4/5GHz 6. W-CDMA Band V / II + BT 7. LTE B5/17 + Wi-Fi 2.4/5GHz 8. LTE B5/17 + BT
Wireless Router (Hotspot)	1. GSM1900 (GPRS) + Wi-Fi 2.4/5.8GHz 2. W-CDMA Band V / II + Wi-Fi 2.4/5.8GHz 3. LTE B5/17 + Wi-Fi 2.4/5.8GHz
Notes: 1. Wi-Fi 2.4/5.8GHz supports Hotspot and Wi-Fi Direct. 2. GPRS, LTE, and W-CDMA support Hotspot. 3. VoIP is supported in W-CDMA, LTE, 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																																														
	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 has one (1) TX/RX antennas and one (1) RX antennas Refer to “Appendix A: SAR Photos & Ant. Locations.”																																																				
Maximum power reduction (MPR)	<table><tr><th colspan="8">Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3</th></tr><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							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
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																																														
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 & Ant. Locations" for the specific details of the antenna-to-antenna and antenna-to-edge(s) distances.

Wireless technologies	RF Exposure Conditions	DUT-to-User Separation	Test Position	Antenna-to-edge/surface	SAR Required	Note
WWAN	Head	0 mm	Left Touch	N/A	Yes	
			Left Tilt (15°)	N/A	Yes	
			Right Touch	N/A	Yes	
			Right Tilt (15°)	N/A	Yes	
	Body	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	
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	Yes	
			Edge 3 (Bottom)	> 25 mm	No	1
			Edge 4 (Left)	> 25 mm	No	1

Notes:

- SAR is not required because the distance from the antenna to the edge is > 25 mm as per KDB 941225 D06 Hot Spot SAR. KDB 648474 D04 Handset SAR (Wi-Fi Direct).

8. Conducted Output Power Measurements

8.1. GSM1900

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	29.2	20.2
				661	1880.0	29.2	20.2
				810	1909.8	29.3	20.3
	GPRS (GMSK)	CS1	1	512	1850.2	29.2	20.2
				661	1880.0	29.2	20.2
				810	1909.8	29.3	20.3
			2	512	1850.2	26.7	20.7
				661	1880.0	27.0	21.0
				810	1909.8	26.8	20.8
			3	512	1850.2	24.6	20.3
				661	1880.0	24.9	20.6
				810	1909.8	24.7	20.4
			4	512	1850.2	23.0	20.0
				661	1880.0	23.3	20.3
				810	1909.8	23.1	20.1

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

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 2
	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	21.7
		4183	836.6	21.7
		4233	846.6	21.6
W-CDMA Band II	Rel 99 (RMC, 12.2 kbps)	9262	1852.4	21.7
		9400	1880.0	21.7
		9538	1907.6	21.7

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-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
HSDPA Specific Settings	MPR (dB)	0	0	0.5	0.5
	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	21.5
		4183	836.6	21.4
		4233	846.6	21.4
	Subtest 2	4132	826.4	21.5
		4183	836.6	21.4
		4233	846.6	21.4
	Subtest 3	4132	826.4	19.5
		4183	836.6	19.5
		4233	846.6	19.5
	Subtest 4	4132	826.4	19.5
		4183	836.6	19.5
		4233	846.6	19.5
W-CDMA Band II	Subtest 1	9262	1852.4	21.5
		9400	1880.0	21.5
		9538	1907.6	21.5
	Subtest 2	9262	1852.4	20.4
		9400	1880.0	20.3
		9538	1907.6	20.2
	Subtest 3	9262	1852.4	19.7
		9400	1880.0	19.7
		9538	1907.6	19.7
	Subtest 4	9262	1852.4	19.5
		9400	1880.0	19.5
		9538	1907.6	19.5

Maximum output power levels that are possible for all subtests reported.

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				
	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	11/15	15/9	2/15	15/0
	β_{hs}	22/15	12/15	30/15	4/15	5/15
	β_{ed}	1309/225	94/75	47/15 47/15	56/75	47/15
HSDPA Specific Settings	CM (dB)	1	3	2	3	1
	MPR (dB)	0	2	1	2	0
	DACK	8				0
	DNAK	8				0
	DCQI	8				0
	Ack-Nack repetition factor	3				
	CQI Feedback (Table 5.2B.4)	4ms				
HSUPA Specific Settings	CQI Repetition Factor (Table 5.2B.4)	2				
	A _{hs} = β_{hs}/β_c	30/15				
	E-DPDCCCH	6	8	8	5	7
	DHARQ	0	0	0	0	0
	AG Index	20	12	15	17	21
	ETFCI (from 34.121 Table C.11.1.3)	75	67	92	71	81
	Associated Max UL Data Rate kbps	242.1	174.9	482.8	205.8	308.9
	Reference E-TFCIs	5	5	2	5	1
	Reference E-TFCI	11	11	11	11	67
	Reference E-TFCI PO	4	4	4	4	18
	Reference E-TFCI	67	67	92	67	67
	Reference E-TFCI PO	18	18	18	18	18
	Reference E-TFCI	71	71	71	71	71
	Reference E-TFCI PO	23	23	23	23	23
	Reference E-TFCI	75	75	75	75	75
	Reference E-TFCI PO	26	26	26	26	26
	Reference E-TFCI	81	81	81	81	81
	Reference E-TFCI PO	27	27	27	27	27
	Maximum Channelisation Codes	2xSF2				SF4

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	21.3
		4183	836.6	21.3
		4233	846.6	21.1
	Subtest 2	4132	826.4	20.0
		4183	836.6	19.9
		4233	846.6	19.8
	Subtest 3	4132	826.4	21.4
		4183	836.6	20.5
		4233	846.6	20.2
	Subtest 4	4132	826.4	21.5
		4183	836.6	21.4
		4233	846.6	21.3
	Subtest 5	4132	826.4	21.3
		4183	836.6	21.2
		4233	846.6	21.1
W-CDMA Band II	Subtest 1	9262	1852.4	19.5
		9400	1880.0	19.5
		9538	1907.6	19.6
	Subtest 2	9262	1852.4	20.2
		9400	1880.0	20.1
		9538	1907.6	20.2
	Subtest 3	9262	1852.4	20.5
		9400	1880.0	20.5
		9538	1907.6	20.6
	Subtest 4	9262	1852.4	21.5
		9400	1880.0	21.5
		9538	1907.6	21.5
	Subtest 5	9262	1852.4	21.2
		9400	1880.0	20.9
		9538	1907.6	21.1

8.3. LTE Band 5, 17

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	22.5	22.5	22.3
			1	25	0	0	22.3	22.4	22.3
			1	49	0	0	22.3	22.0	21.1
			25	0	1	1	21.1	21.1	21.0
			25	12	1	1	21.1	21.0	21.0
			25	25	1	1	21.1	21.0	21.0
			50	0	1	1	21.2	21.0	21.0
		16QAM	1	0	1	1	22.0	22.0	21.0
			1	25	1	1	22.0	22.0	21.3
			1	49	1	1	21.6	21.0	20.9
			25	0	2	2	20.2	20.1	20.0
			25	12	2	2	20.2	20.0	20.2
			25	25	2	2	20.3	20.0	20.3
			50	0	2	2	19.9	20.1	20.2
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	22.1	21.9	22.2
			1	12	0	0	22.2	21.9	22.2
			1	24	0	0	22.3	22.0	22.1
			12	0	1	1	21.1	21.1	21.1
			12	6	1	1	21.1	21.1	21.1
			12	11	1	1	21.0	21.0	21.1
			25	0	1	1	21.1	21.0	21.0
		16QAM	1	0	1	1	21.4	21.5	21.0
			1	12	1	1	21.3	21.0	21.8
			1	24	1	1	21.5	21.3	21.0
			12	0	2	2	20.4	20.1	20.5
			12	6	2	2	20.3	20.2	20.4
			12	11	2	2	20.4	20.1	20.2
			25	0	2	2	20.1	20.1	20.0
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	22.0	22.0	22.0
			1	7	0	0	22.1	22.0	22.1
			1	14	0	0	22.0	21.9	21.9
			8	0	1	1	21.0	21.0	21.0
			8	4	1	1	21.1	21.1	21.0
			8	7	1	1	21.0	20.9	20.9
			15	0	1	1	21.1	21.1	21.0
		16QAM	1	0	1	1	21.0	21.1	21.1
			1	7	1	1	21.1	21.1	21.1
			1	14	1	1	20.9	21.0	20.9
			8	0	2	2	20.0	20.1	20.1
			8	4	2	2	20.1	20.1	20.1
			8	7	2	2	20.0	20.1	20.0
			15	0	2	2	20.1	20.2	20.0

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	22.3	22.3	22.3
			1	2	0	0	22.2	22.3	22.3
			1	5	0	0	22.3	22.3	22.3
			3	0	0	0	22.3	22.3	22.3
			3	1	0	0	22.2	22.3	22.4
			3	2	0	0	22.2	22.2	22.3
			6	0	1	1	21.2	21.2	21.2
		16QAM	1	0	1	1	21.2	21.3	21.3
			1	2	1	1	21.2	21.2	21.3
			1	5	1	1	21.3	21.3	21.3
			3	0	1	1	21.3	21.3	21.3
			3	1	1	1	21.3	21.3	21.3
			3	2	1	1	21.3	21.3	21.3
			6	0	2	2	20.2	20.3	20.3

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	23.5
			1	25	0	0	23.3
			1	49	0	0	23.1
			25	0	1	1	22.3
			25	12	1	1	22.2
			25	25	1	1	22.1
			50	0	1	1	22.1
		16QAM	1	0	1	1	22.1
			1	25	1	1	22.5
			1	49	1	1	22.5
			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	23.0
			1	12	0	0	22.8
			1	24	0	0	22.7
			12	0	1	1	21.8
			12	6	1	1	21.8
			12	11	1	1	21.8
			25	0	1	1	21.7
		16QAM	1	0	1	1	22.2
			1	12	1	1	22.2
			1	24	1	1	21.9
			12	0	2	2	21.0
			12	6	2	2	20.8
			12	11	2	2	21.0
			25	0	2	2	20.6

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

8.4. Wi-Fi (2.4 GHz Band)

Required Test Channels per KDB 248227 D01

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	17.5	Yes
			6	2437	17.5	
			11	2462	17.4	
	802.11g	6 Mbps	1	2412	14.5	No
			6	2437	14.4	
			11	2462	14.4	
	802.11n (HT20)	MCS0	1	2412	12.5	No
			6	2437	12.5	
			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	17.5	Yes
			2 Mbps	17.5	No
			5.5 Mbps	17.5	No
			11 Mbps	17.5	No

Note(s):

- Per KDB 248227 D01,
 - Testing at higher data rates and higher order modulations is not required when the maximum average output power for each of these configurations is < ¼ dB higher than those measured at the lowest data rate.
 - Each channel should be tested at the lowest data rate in each a-b/g mode channel BW configuration.

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	12.5	Yes
			40	5200	12.5	
			44	5220	12.5	
			48	5240	12.5	
	802.11n (HT20)	MCS0	36	5180	12.5	No
			40	5200	12.5	
			48	5240	12.5	
	802.11n (HT40)	MCS0	40	5200	12.5	No
			48	5240	12.5	
5.3 (UNII)	802.11a	6 Mbps	52	5260	12.5	Yes
			56	5280	12.5	
			60	5300	12.5	
			64	5320	12.5	
	802.11n (HT20)	MCS0	52	5260	12.5	No
			60	5300	12.4	
			64	5320	12.4	
	802.11n (HT40)	MCS0	56	5280	12.5	No
			60	5300	12.5	
5.5 (UNII)	802.11a	6 Mbps	100	5500	12.5	Yes
			104	5520	12.5	
			108	5540	12.3	
			112	5560	12.3	
			116	5580	12.3	
			132	5660	12.3	
			136	5680	12.3	
			140	5700	12.2	
	802.11n (HT20)	MCS0	100	5500	12.3	No
			116	5580	12.3	
			140	5700	12.5	
	802.11n (HT40)	MCS0	104	5520	12.5	No
			112	5560	12.5	
			136	5680	12.5	
			140	5700	12.5	
5.8 (DTS)	802.11a	6 Mbps	149	5745	12.5	Yes
			153	5765	12.5	
			157	5785	12.5	
			161	5805	12.5	
			165	5825	12.5	
	802.11n (HT20)	MCS0	149	5745	12.5	No
			157	5785	12.5	
			161	5805	12.5	
	802.11n (HT40)	MCS0	153	5765	12.5	No
			161	5805	12.5	
			161	5805	12.5	

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	36	5180	6 Mbps	12.5	Yes
				9 Mbps	12.5	No
				12 Mbps	12.4	No
				18 Mbps	12.5	No
				24 Mbps	12.5	No
				36 Mbps	12.5	No
				48 Mbps	12.4	No
				54 Mbps	12.3	No
5.3 GHz (UNII)	802.11a	52	5260	6 Mbps	12.5	Yes
				9 Mbps	12.5	No
				12 Mbps	12.1	No
				18 Mbps	12.0	No
				24 Mbps	12.2	No
				36 Mbps	12.1	No
				48 Mbps	12.5	No
				54 Mbps	12.5	No
5.5 GHz (UNII)	802.11a	104	5520	6 Mbps	12.5	Yes
				9 Mbps	12.5	No
				12 Mbps	12.5	No
				18 Mbps	11.0	No
				24 Mbps	11.5	No
				36 Mbps	12.5	No
				48 Mbps	12.5	No
				54 Mbps	12.5	No
5.8 GHz (DTS)	802.11a	157	5785	6 Mbps	12.5	Yes
				9 Mbps	12.4	No
				12 Mbps	12.5	No
				18 Mbps	11.1	No
				24 Mbps	12.1	No
				36 Mbps	11.0	No
				48 Mbps	11.0	No
				54 Mbps	12.5	No

Note(s):

- Per KDB 248227 D01,
 - Testing at higher data rates and higher order modulations is not required when the maximum average output power for each of these configurations is < ¼ dB higher than those measured at the lowest data rate.
 - Each channel should be tested at the lowest data rate in each a-b/g mode channel BW configuration.

8.6. Bluetooth

Maximum tune-up tolerance limit is 11 dBm from the rated nominal maximum output power. This power level qualifies for exclusion of SAR testing.

9. Dielectric Property Measurements

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 A

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
11/24/2014	Head 835	e'	41.8800	Relative Permittivity (ε _r):	41.88	41.50	0.92	5
		e"	18.9500	Conductivity (σ):	0.88	0.90	-2.24	5
	Head 820	e'	42.2000	Relative Permittivity (ε _r):	42.20	41.60	1.44	5
		e"	19.1600	Conductivity (σ):	0.87	0.90	-2.77	5
	Head 850	e'	41.3900	Relative Permittivity (ε _r):	41.39	41.50	-0.27	5
		e"	18.9400	Conductivity (σ):	0.90	0.92	-2.17	5
11/24/2014	Body 835	e'	55.8200	Relative Permittivity (ε _r):	55.82	55.20	1.12	5
		e"	20.6200	Conductivity (σ):	0.96	0.97	-1.30	5
	Body 820	e'	56.2100	Relative Permittivity (ε _r):	56.21	55.28	1.69	5
		e"	21.1600	Conductivity (σ):	0.96	0.97	-0.38	5
	Body 850	e'	55.2100	Relative Permittivity (ε _r):	55.21	55.16	0.10	5
		e"	20.1100	Conductivity (σ):	0.95	0.99	-3.72	5
11/24/2014	Head 1900	e'	39.4000	Relative Permittivity (ε _r):	39.40	40.00	-1.50	5
		e"	13.5500	Conductivity (σ):	1.43	1.40	2.25	5
	Head 1850	e'	39.6500	Relative Permittivity (ε _r):	39.65	40.00	-0.88	5
		e"	13.0800	Conductivity (σ):	1.35	1.40	-3.89	5
	Head 1910	e'	39.3900	Relative Permittivity (ε _r):	39.39	40.00	-1.53	5
		e"	13.7200	Conductivity (σ):	1.46	1.40	4.08	5
11/24/2014	Body 1900	e'	54.2200	Relative Permittivity (ε _r):	54.22	53.30	1.73	5
		e"	14.6200	Conductivity (σ):	1.54	1.52	1.61	5
	Body 1850	e'	54.4200	Relative Permittivity (ε _r):	54.42	53.30	2.10	5
		e"	14.3800	Conductivity (σ):	1.48	1.52	-2.68	5
	Body 1910	e'	54.1600	Relative Permittivity (ε _r):	54.16	53.30	1.61	5
		e"	14.7000	Conductivity (σ):	1.56	1.52	2.71	5
12/1/2014	Head 835	e'	41.5000	Relative Permittivity (ε _r):	41.50	41.50	0.00	5
		e"	19.5700	Conductivity (σ):	0.91	0.90	0.96	5
	Head 820	e'	41.2100	Relative Permittivity (ε _r):	41.21	41.60	-0.94	5
		e"	18.9800	Conductivity (σ):	0.87	0.90	-3.68	5
	Head 850	e'	42.4400	Relative Permittivity (ε _r):	42.44	41.50	2.27	5
		e"	19.9800	Conductivity (σ):	0.94	0.92	3.20	5
12/1/2014	Body 835	e'	53.3700	Relative Permittivity (ε _r):	53.37	55.20	-3.32	5
		e"	21.4200	Conductivity (σ):	0.99	0.97	2.53	5
	Body 820	e'	53.7200	Relative Permittivity (ε _r):	53.72	55.28	-2.82	5
		e"	21.7400	Conductivity (σ):	0.99	0.97	2.35	5
	Body 850	e'	52.9000	Relative Permittivity (ε _r):	52.90	55.16	-4.09	5
		e"	20.9800	Conductivity (σ):	0.99	0.99	0.45	5

SAR Lab A (continued)

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
12/2/2014	Head 750	e'	41.5900	Relative Permittivity (ϵ_r):	41.59	41.96	-0.89	5
		e"	21.7200	Conductivity (σ):	0.91	0.89	1.42	5
	Head 700	e'	42.0400	Relative Permittivity (ϵ_r):	42.04	42.22	-0.42	5
		e"	22.2000	Conductivity (σ):	0.86	0.89	-2.83	5
	Head 720	e'	41.8200	Relative Permittivity (ϵ_r):	41.82	42.12	-0.70	5
		e"	22.0000	Conductivity (σ):	0.88	0.89	-1.12	5
12/2/2014	Body 750	e'	53.5200	Relative Permittivity (ϵ_r):	53.52	55.55	-3.65	5
		e"	23.0000	Conductivity (σ):	0.96	0.96	-0.41	5
	Body 700	e'	53.9400	Relative Permittivity (ϵ_r):	53.94	55.74	-3.23	5
		e"	23.9000	Conductivity (σ):	0.93	0.96	-3.02	5
	Body 790	e'	52.7500	Relative Permittivity (ϵ_r):	52.75	55.39	-4.77	5
		e"	22.9300	Conductivity (σ):	1.01	0.97	4.25	5

SAR Lab B

Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)	
11/24/2014	Head 5180	e'	36.3400	Relative Permittivity (ε _r):	36.34	36.01	0.91	5
		e''	16.0500	Conductivity (σ):	4.62	4.63	-0.17	5
	Head 5200	e'	36.7600	Relative Permittivity (ε _r):	36.76	35.99	2.14	5
		e''	16.5100	Conductivity (σ):	4.77	4.65	2.64	5
	Head 5600	e'	36.8100	Relative Permittivity (ε _r):	36.81	35.53	3.59	5
		e''	16.4200	Conductivity (σ):	5.11	5.06	1.04	5
	Head 5800	e'	36.2700	Relative Permittivity (ε _r):	36.27	35.30	2.75	5
		e''	16.7900	Conductivity (σ):	5.41	5.27	2.75	5
	Head 5825	e'	36.6200	Relative Permittivity (ε _r):	36.62	35.30	3.74	5
		e''	16.8100	Conductivity (σ):	5.44	5.27	3.31	5
11/24/2014	Body 5180	e'	49.0000	Relative Permittivity (ε _r):	49.00	49.05	-0.10	5
		e''	18.3200	Conductivity (σ):	5.28	5.27	0.10	5
	Body 5200	e'	48.9100	Relative Permittivity (ε _r):	48.91	49.02	-0.22	5
		e''	18.3000	Conductivity (σ):	5.29	5.29	-0.07	5
	Body 5600	e'	48.2500	Relative Permittivity (ε _r):	48.25	48.48	-0.47	5
		e''	18.7000	Conductivity (σ):	5.82	5.76	1.07	5
	Body 5800	e'	47.9500	Relative Permittivity (ε _r):	47.95	48.20	-0.52	5
		e''	18.8700	Conductivity (σ):	6.09	6.00	1.43	5
	Body 5825	e'	47.8800	Relative Permittivity (ε _r):	47.88	48.20	-0.66	5
		e''	19.0000	Conductivity (σ):	6.15	6.00	2.56	5
12/1/2014	Head 5180	e'	35.5800	Relative Permittivity (ε _r):	35.58	36.01	-1.20	5
		e''	15.8600	Conductivity (σ):	4.57	4.63	-1.35	5
	Head 5200	e'	35.9300	Relative Permittivity (ε _r):	35.93	35.99	-0.17	5
		e''	16.1100	Conductivity (σ):	4.66	4.65	0.15	5
	Head 5600	e'	35.8400	Relative Permittivity (ε _r):	35.84	35.53	0.86	5
		e''	15.8100	Conductivity (σ):	4.92	5.06	-2.71	5
	Head 5800	e'	35.4000	Relative Permittivity (ε _r):	35.40	35.30	0.28	5
		e''	16.8200	Conductivity (σ):	5.42	5.27	2.93	5
	Head 5825	e'	35.7300	Relative Permittivity (ε _r):	35.73	35.30	1.22	5
		e''	16.2400	Conductivity (σ):	5.26	5.27	-0.19	5
12/2/2014	Head 2450	e'	38.0000	Relative Permittivity (ε _r):	38.00	39.20	-3.06	5
		e''	13.2000	Conductivity (σ):	1.80	1.80	-0.10	5
	Head 2410	e'	37.9100	Relative Permittivity (ε _r):	37.91	39.28	-3.49	5
		e''	13.2400	Conductivity (σ):	1.77	1.76	0.78	5
	Head 2475	e'	37.8600	Relative Permittivity (ε _r):	37.86	39.17	-3.34	5
		e''	13.1000	Conductivity (σ):	1.80	1.83	-1.33	5
12/2/2014	Body 2450	e'	50.9400	Relative Permittivity (ε _r):	50.94	52.70	-3.34	5
		e''	14.3200	Conductivity (σ):	1.95	1.95	0.04	5
	Body 2410	e'	50.8400	Relative Permittivity (ε _r):	50.84	52.76	-3.64	5
		e''	14.3000	Conductivity (σ):	1.92	1.91	0.46	5
	Body 2475	e'	50.8200	Relative Permittivity (ε _r):	50.82	52.67	-3.51	5
		e''	14.1700	Conductivity (σ):	1.95	1.99	-1.77	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 re-measured or sooner when marginal liquid parameters are used at the beginning of a series of measurements.

10.1. 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.

10.2. Reference Target SAR Values

The reference SAR values are obtained from the calibration certificate of system validation dipoles. The measured values are normalized to 1 Watt.

System Dipole	Serial No.	Cal. Date	Freq. (MHz)	Target SAR Values (W/kg)		
				1g/10g	Head	Body
D750V3	1024	5/16/2014	750	1g	8.12	8.77
				10g	5.26	5.79
D835V2	4d117	5/16/2014	835	1g	9.23	9.61
				10g	5.98	6.31
D1900V2	5d163	9/11/2014	1900	1g	40.8	40.6
				10g	21.2	21.4
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

10.3. 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 A

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			
11/24/2014	D835V2	4d117	Head	1g	0.938	9.4	9.23	1.63
				10g	0.614	6.1	5.98	2.68
11/24/2014	D835V2	4d117	Body	1g	0.985	9.9	9.61	2.50
				10g	0.648	6.5	6.31	2.69
11/24/2014	D1900V2	5d163	Head	1g	4.10	41.0	40.8	0.49
				10g	2.09	20.9	21.2	-1.42
11/24/2014	D1900V2	5d163	Body	1g	4.15	41.5	40.6	2.22
				10g	2.12	21.2	21.4	-0.93
12/1/2014	D835V2	4d117	Head	1g	0.972	9.7	9.23	5.31
				10g	0.636	6.4	5.98	6.35
12/1/2014	D835V2	4d117	Body	1g	1.030	10.3	9.61	7.18
				10g	0.676	6.8	6.31	7.13
12/2/2014	D750V2	1024	Head	1g	0.807	8.1	8.12	-0.62
				10g	0.527	5.3	5.26	0.19
12/2/2014	D750V2	1024	Body	1g	0.910	9.1	8.77	3.76
				10g	0.604	6.0	5.79	4.32

SAR Lab B

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			
11/24/2014	D5GHzV2 (5200)	1003	Head	1g	8.08	80.8	77.7	3.99
				10g	2.32	23.2	22.2	4.50
11/24/2014	D5GHzV2 (5200)	1003	Body	1g	7.34	73.4	73.5	-0.14
				10g	2.06	20.6	20.5	0.49
11/24/2014	D5GHzV2 (5600)	1003	Head	1g	8.63	86.3	81.8	5.50
				10g	2.44	24.4	23.2	5.17
11/24/2014	D5GHzV2 (5600)	1003	Body	1g	7.55	75.5	79.6	-5.15
				10g	2.10	21.0	22.1	-4.98
11/24/2014	D5GHzV2 (5800)	1003	Head	1g	7.93	79.3	78.3	1.28
				10g	2.25	22.5	22.1	1.81
11/24/2014	D5GHzV2 (5800)	1003	Body	1g	7.15	71.5	73.8	-3.12
				10g	1.97	19.7	20.4	-3.43
12/1/2014	D5GHzV2 (5200)	1003	Head	1g	7.97	79.7	77.7	2.57
				10g	2.27	22.7	22.2	2.25
12/1/2014	D5GHzV2 (5600)	1003	Head	1g	8.56	85.6	81.8	4.65
				10g	2.41	24.1	23.2	3.88
12/2/2014	D2450V2	706	Head	1g	5.40	54.0	53.0	1.89
				10g	2.45	24.5	24.5	0.00
12/2/2014	D2450V2	706	Body	1g	5.24	52.4	50.2	4.38
				10g	2.39	23.9	23.4	2.14

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. 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	30.0	29.2	0.034	0.041	0.021	0.025	1
			Left Tilt	661	1880.0	30.0	29.2	0.017	0.020	0.009	0.010	
			Right Touch	661	1880.0	30.0	29.2	0.030	0.036	0.017	0.020	
			Right Tilt	661	1880.0	30.0	29.2	0.018	0.022	0.009	0.011	
Head VoIP	GPRS 2 Slots	0	Left Touch	661	1880.0	27.5	27.0	0.049	0.055	0.030	0.034	2
			Left Tilt	661	1880.0	27.5	27.0	0.025	0.028	0.014	0.016	
			Right Touch	661	1880.0	27.5	27.0	0.039	0.044	0.023	0.026	
			Right Tilt	661	1880.0	27.5	27.0	0.024	0.027	0.013	0.015	
Body-worn	Voice	10	Rear	661	1880.0	30.0	29.2	0.183	0.220	0.104	0.125	3
			Front	661	1880.0	30.0	29.2	0.154	0.185	0.090	0.108	
Body-worn(VoIP) & Hotspot	GPRS 2 Slots	10	Rear	661	1880.0	27.5	27.0	0.238	0.267	0.137	0.154	
Front			661	1880.0	27.5	27.0	0.206	0.231	0.120	0.135		
Hotspot			Edge 2	661	1880.0	27.5	27.0	0.007	0.008	0.004	0.004	
			Edge 3	661	1880.0	27.5	27.0	0.374	0.420	0.206	0.231	4
			Edge 4	661	1880.0	27.5	27.0	0.074	0.083	0.039	0.044	

11.2. 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	21.7	0.008	0.011	0.005	0.007	
			Left Tilt	4183	836.6	23.0	21.7	0.004	0.005	0.002	0.003	
			Right Touch	4183	836.6	23.0	21.7	0.009	0.012	0.007	0.009	5
			Right Tilt	4183	836.6	23.0	21.7	0.003	0.005	0.002	0.003	
Body-worn & Hptspot	Rel 99 RMC	10	Rear	4183	836.6	23.0	21.7	0.064	0.086	0.036	0.049	6
			Front	4183	836.6	23.0	21.7	0.057	0.077	0.032	0.043	
Hotspot	Rel 99 RMC	10	Edge 2	4183	836.6	23.0	21.7	0.014	0.019	0.009	0.013	
			Edge 3	4183	836.6	23.0	21.7	0.036	0.049	0.021	0.028	
			Edge 4	4183	836.6	23.0	21.7	0.010	0.013	0.006	0.008	

11.3. 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	21.7	0.071	0.096	0.043	0.058	7
			Left Tilt	9400	1880.0	23.0	21.7	0.033	0.045	0.019	0.026	
			Right Touch	9400	1880.0	23.0	21.7	0.055	0.074	0.032	0.043	
			Right Tilt	9400	1880.0	23.0	21.7	0.029	0.039	0.016	0.022	
Body-worn & Hptspot	Rel 99 RMC	10	Rear	9400	1880.0	23.0	21.7	0.330	0.445	0.189	0.255	8
			Front	9400	1880.0	23.0	21.7	0.278	0.375	0.161	0.217	
Hotspot	Rel 99 RMC	10	Edge 2	9400	1880.0	23.0	21.7	0.018	0.024	0.011	0.015	
			Edge 3	9400	1880.0	23.0	21.7	0.524	0.707	0.285	0.384	9
			Edge 4	9400	1880.0	23.0	21.7	0.110	0.148	0.059	0.080	

11.4. 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	23.5	22.5	0.010	0.013	0.007	0.009	10
						25	0	22.5	21.1	0.008	0.011	0.005	0.007	
			Left Tilt	20525	836.5	1	0	23.5	22.5	0.004	0.005	0.003	0.004	
						25	0	22.5	21.1	0.003	0.004	0.002	0.002	
			Right Touch	20525	836.5	1	0	23.5	22.5	0.011	0.014	0.008	0.010	
						25	0	22.5	21.1	0.007	0.010	0.006	0.008	
Body-worn & Hotspot	QPSK	10	Rear	20525	836.5	1	0	23.5	22.5	0.086	0.108	0.048	0.060	11
						25	0	22.5	21.1	0.065	0.090	0.036	0.050	
			Front	20525	836.5	1	0	23.5	22.5	0.067	0.084	0.038	0.048	
						25	0	22.5	21.1	0.050	0.069	0.029	0.040	
Hotspot	QPSK	10	Edge 2	20525	836.5	1	0	23.5	22.5	0.017	0.021	0.012	0.015	
						25	0	22.5	21.1	0.013	0.018	0.008	0.011	
			Edge 3	20525	836.5	1	0	23.5	22.5	0.047	0.059	0.027	0.034	
						25	0	22.5	21.1	0.036	0.050	0.021	0.029	
			Edge 4	20525	836.5	1	0	23.5	22.5	0.011	0.014	0.007	0.009	
						25	0	22.5	21.1	0.008	0.012	0.005	0.007	

11.5. 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)		10-g SAR (W/kg)		Plot No.
								Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled	
Head	QPSK	0	Left Touch	23790	710.0	1	0	23.5	23.5	0.006	0.006	0.004	0.004	12
						25	0	22.5	22.3	0.005	0.005	0.003	0.003	
			Left Tilt	23790	710.0	1	0	23.5	23.5	0.003	0.003	0.003	0.003	
						25	0	22.5	22.3	0.003	0.003	0.002	0.002	
			Right Touch	23790	710.0	1	0	23.5	23.5	0.006	0.006	0.005	0.005	
						25	0	22.5	22.3	0.005	0.005	0.004	0.004	
Body-worn & Hotspot	QPSK	10	Rear	23790	710.0	1	0	23.5	23.5	0.042	0.042	0.024	0.024	13
						25	0	22.5	22.3	0.033	0.035	0.019	0.020	
			Front	23790	710.0	1	0	23.5	23.5	0.036	0.036	0.021	0.021	
						25	0	22.5	22.3	0.029	0.030	0.016	0.017	
Hotspot	QPSK	10	Edge 2	23790	710.0	1	0	23.5	23.5	0.018	0.018	0.012	0.012	
						25	0	22.5	22.3	0.014	0.015	0.010	0.010	
			Edge 3	23790	710.0	1	0	23.5	23.5	0.017	0.017	0.008	0.008	
						25	0	22.5	22.3	0.011	0.012	0.005	0.006	
			Edge 4	23790	710.0	1	0	23.5	23.5	0.006	0.006	0.003	0.003	
						25	0	22.5	22.3	0.004	0.005	0.003	0.003	

11.6. Wi-Fi (DTS Band)

11.6.1. Wi-Fi 2.4 GHz

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	802.11b 1 Mbps	0	Left Touch	1	2412	17.5	17.5	0.929	0.929	0.394	0.394	
				6	2437	17.5	17.5	0.974	0.974	0.388	0.388	
				11	2462	17.5	17.4	0.899	0.920	0.355	0.363	
			Left Tilt	1	2412	17.5	17.5	0.880	0.880	0.386	0.386	
				6	2437	17.5	17.5	0.797	0.797	0.344	0.344	
				11	2462	17.5	17.4	0.784	0.802	0.334	0.342	
			Right Touch	1	2412	17.5	17.5	0.935	0.935	0.409	0.409	
				6	2437	17.5	17.5	0.883	0.883	0.378	0.378	
				11	2462	17.5	17.4	0.870	0.890	0.370	0.379	
			Right Tilt	1	2412	17.5	17.5	0.977	0.977	0.416	0.416	14
				6	2437	17.5	17.5	0.934	0.934	0.388	0.388	
				11	2462	17.5	17.4	0.926	0.948	0.379	0.388	
Body-worn & Hotspot	802.11b 1 Mbps	10	Rear	6	2437	17.5	17.5	0.221	0.221	0.111	0.111	15
			Front	6	2437	17.5	17.5	0.221	0.221	0.109	0.109	
Hotspot	802.11b 1 Mbps	10	Edge 1	6	2437	17.5	17.5	0.420	0.420	0.205	0.205	16
			Edge 2	6	2437	17.5	17.5	0.028	0.028	0.014	0.014	

11.6.2. Wi-Fi 5.8 GHz

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	802.11a 6 Mbps	0	Left Touch	149	5745	12.5	12.5	0.770	0.770	0.191	0.191	17
				157	5785	12.5	12.5	0.698	0.698	0.170	0.170	
				165	5825	12.5	12.5	0.697	0.697	0.169	0.169	
			Left Tilt	157	5785	12.5	12.5	0.545	0.545	0.135	0.135	
			Right Touch	157	5785	12.5	12.5	0.228	0.228	0.068	0.068	
			Right Tilt	157	5785	12.5	12.5	0.217	0.217	0.068	0.068	
Body-worn	802.11a 6 Mbps	10	Rear	157	5785	12.5	12.5	0.214	0.214	0.066	0.066	18
			Front	157	5785	12.5	12.5	0.087	0.087	0.026	0.026	
Hotspot	802.11a 6 Mbps	10	Edge 1	157	5785	12.5	12.5	0.071	0.071	0.022	0.022	
			Edge 2	157	5785	12.5	12.5	0.073	0.073	0.028	0.028	19

11.7. Wi-Fi (UNII 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	
Head	802.11a 6 Mbps	0	Left Touch	36	5180	12.5	12.5	0.725	0.725	0.176	0.176	20
				52	5260	12.5	12.5	0.988	0.988	0.250	0.250	
				64	5320	12.5	12.5	1.090	1.090	0.278	0.278	21
				104	5520	12.5	12.5	1.030	1.030	0.275	0.275	22
				116	5580	12.5	12.3	0.964	1.009	0.247	0.259	
				136	5680	12.5	12.3	0.781	0.818	0.198	0.207	
			Left Tilt	36	5180	12.5	12.5	0.588	0.588	0.143	0.143	
				52	5260	12.5	12.5	0.819	0.819	0.207	0.207	
				64	5320	12.5	12.5	1.050	1.050	0.263	0.263	
				104	5520	12.5	12.5	0.849	0.849	0.224	0.224	
				116	5580	12.5	12.3	0.896	0.938	0.239	0.250	
				136	5680	12.5	12.3	0.636	0.666	0.164	0.172	
			Right Touch	36	5180	12.5	12.5	0.479	0.479	0.134	0.134	
				52	5260	12.5	12.5	0.639	0.639	0.182	0.182	
				104	5520	12.5	12.5	0.512	0.512	0.166	0.166	
				116	5580	12.5	12.3	0.543	0.569	0.177	0.185	
			Right Tilt	136	5680	12.5	12.3	0.326	0.341	0.101	0.106	
				36	5180	12.5	12.5	0.447	0.447	0.121	0.121	
				52	5260	12.5	12.5	0.658	0.658	0.186	0.186	
				104	5520	12.5	12.5	0.544	0.544	0.173	0.173	
				116	5580	12.5	12.3	0.539	0.564	0.171	0.179	
				136	5680	12.5	12.3	0.341	0.357	0.108	0.113	
Body-worn	802.11a 6 Mbps	10	Rear	36	5180	12.5	12.5	0.193	0.193	0.058	0.058	23
				52	5260	12.5	12.5	0.213	0.213	0.068	0.068	24
				116	5580	12.5	12.3	0.230	0.241	0.071	0.074	25
			Front	36	5180	12.5	12.5	0.104	0.104	0.034	0.034	
				52	5260	12.5	12.5	0.156	0.156	0.052	0.052	
				116	5580	12.5	12.3	0.109	0.114	0.037	0.039	

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)			
11.0	13	10	2.480	2.0

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	13	10	2.480	0.273

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

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
700	LTE Band 17	Body and Hotspot	Rear	No	0.042	N/A	N/A
850	WCDMA Band V	Body and Hotspot	Rear	No	0.064	N/A	N/A
	LTE Band 5	Body and Hotspot	Rear	No	0.086	N/A	N/A
1900	GSM 1900	Hotspot	Edge 3	No	0.374	N/A	N/A
	WCDMA Band II	Hotspot	Edge 3	No	0.524	N/A	N/A
2400	Wi-Fi 802.11b/g/n	Head	Right Tilt	Yes	0.977	0.971	1.01
5200	Wi-Fi 802.11a/n	Head	Left Touch	No	0.725	N/A	N/A
5300	Wi-Fi 802.11a/n	Head	Left Touch	Yes	1.09	1.06	1.03
5500	Wi-Fi 802.11a/n	Head	Left Touch	Yes	1.03	0.988	1.04
5800	Wi-Fi 802.11a/n	Head	Left Touch	No	0.77	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 .

13. Simultaneous Transmission SAR Analysis

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

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

Where:

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 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	0.055	0.974			1.029	No
		① + ③	0.055		1.090		1.145	No
	Left Tilt	① + ②	0.028	0.880			0.908	No
		① + ③	0.028		1.050		1.078	No
	Right Touch	① + ②	0.044	0.935			0.979	No
		① + ③	0.044		0.639		0.683	No
	Right Tilt	① + ②	0.027	0.977			1.004	No
		① + ③	0.027		0.658		0.685	No
Body-w orn Accessory & Hotspot	Rear	① + ②	0.267	0.221			0.488	No
		① + ③	0.267		0.241		0.508	No
		① + ④	0.267			0.273	0.540	No
	Front	① + ②	0.231	0.221			0.452	No
		① + ③	0.231		0.156		0.387	No
		① + ④	0.231			0.273	0.504	No
Hotspot	Edge 2	① + ②	0.008	0.073			0.081	No

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

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario				Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① WCDMA Band V	② Wi-Fi(DTS)	③ Wi-Fi(UNII)	④ Bluetooth		
Head	Left Touch	① + ②	0.011	0.974			0.985	No
		① + ③	0.011		1.090		1.101	No
	Left Tilt	① + ②	0.005	0.880			0.885	No
		① + ③	0.005		1.050		1.055	No
	Right Touch	① + ②	0.012	0.935			0.947	No
		① + ③	0.012		0.639		0.651	No
	Right Tilt	① + ②	0.005	0.977			0.982	No
		① + ③	0.005		0.658		0.663	No
Body-w orn Accessory & Hotspot	Rear	① + ②	0.086	0.221			0.307	No
		① + ③	0.086		0.241		0.327	No
		① + ④	0.086			0.273	0.359	No
	Front	① + ②	0.077	0.221			0.298	No
		① + ③	0.077		0.156		0.233	No
		① + ④	0.077			0.273	0.350	No
Hotspot	Edge 2	① + ②	0.019	0.073			0.092	No

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

RF Exposure conditions	Test Position	Simultaneous Transmission Scenario				Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
		① WCDMA Band II	② Wi-Fi(DTS)	③ Wi-Fi(UNII)	④ Bluetooth		
Head	Left Touch	① + ②	0.096	0.974		1.070	No
		① + ③	0.096	1.090		1.186	No
	Left Tilt	① + ②	0.045	0.880		0.925	No
		① + ③	0.045	1.050		1.095	No
	Right Touch	① + ②	0.074	0.935		1.009	No
		① + ③	0.074	0.639		0.713	No
	Right Tilt	① + ②	0.039	0.977		1.016	No
		① + ③	0.039	0.658		0.697	No
Body-w orn Accessory & Hotspot	Rear	① + ②	0.445	0.221		0.666	No
		① + ③	0.445	0.241		0.686	No
		① + ④	0.445		0.273	0.718	No
	Front	① + ②	0.375	0.221		0.596	No
		① + ③	0.375	0.156		0.531	No
		① + ④	0.375		0.273	0.648	No
Hotspot	Edge 2	① + ②	0.024	0.073		0.097	No

13.4. 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	0.013	0.974		0.987	No
		① + ③	0.013	1.090		1.103	No
	Left Tilt	① + ②	0.005	0.880		0.885	No
		① + ③	0.005	1.050		1.055	No
	Right Touch	① + ②	0.014	0.935		0.949	No
		① + ③	0.014	0.639		0.653	No
	Right Tilt	① + ②	0.006	0.977		0.983	No
		① + ③	0.006	0.658		0.664	No
Body-w orn Accessory & Hotspot	Rear	① + ②	0.108	0.221		0.329	No
		① + ③	0.108	0.241		0.349	No
		① + ④	0.108		0.273	0.381	No
	Front	① + ②	0.084	0.221		0.305	No
		① + ③	0.084	0.156		0.240	No
		① + ④	0.084		0.273	0.357	No
Hotspot	Edge 2	① + ②	0.021	0.073		0.094	No

13.5. 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	0.006	0.974			0.980	No
		① + ③	0.006		1.090		1.096	No
	Left Tilt	① + ②	0.003	0.880			0.883	No
		① + ③	0.003		1.050		1.053	No
	Right Touch	① + ②	0.006	0.935			0.941	No
		① + ③	0.006		0.639		0.645	No
	Right Tilt	① + ②	0.003	0.977			0.980	No
		① + ③	0.003		0.658		0.661	No
Body-w orn Accessory & Hotspot	Rear	① + ②	0.042	0.221			0.263	No
		① + ③	0.042		0.241		0.283	No
		① + ④	0.042			0.273	0.315	No
	Front	① + ②	0.036	0.221			0.257	No
		① + ③	0.036		0.156		0.192	No
		① + ④	0.036			0.273	0.309	No
Hotspot	Edge 2	① + ②	0.018	0.073			0.091	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_14U19434v0 SAR Photos & Ant. Locations

B_14U19434v0 SAR System Check Plots

C_14U19434v0 SAR Highest Test Plots

D_14U19434v0 SAR Tissue Ingredients

E_14U19434v0 SAR Probe Cal. Certificates

F_14U19434v0 SAR Dipole Cal. Certificates

END OF REPORT