



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+ and NFC

**Model: SM-A500S, SM-A500K, SM-A500L
FCC ID: A3LSMA500KOR**

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REVISION HISTORY

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--	12/1/2014	Initial Issue	--
A	12/3/2014	Section 1: Updated Highest Reported SAR Table Section 13" Updated Sum of SAR Tables	Coltyce Sanders

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1. Attestation of Test Results

Applicant Name	Samsung Electronics Co., Ltd.				
FCC ID	A3LSMA500KOR				
DUT Description	GSM/WCDMA/LTE Phone + Bluetooth, DTS/UNII a/b/g/n, ANT+ and NFC				
Exposure Category	General Population/Uncontrolled Exposure				
Applicable Standards	FCC 47 CFR § 2.1093 Published RF exposure KDB procedures IEEE Std 1528-2013				
Dates tested	11/10/2014 – 11/12/2014				
The Highest Reported SAR (W/kg)					
RF Exposure Conditions		Equipment Class			
		Licensed	DTS	UNII	DSS
Head		0.322	0.467	1.108	N/A
Body-worn		0.948	0.067	0.206	
Hotspot/Wi-Fi Direct		1.055		N/A	
Simultaneous Transmission:	Head	1.430	0.789	1.430	N/A
	Body-worn			1.120	
	Hotspot/Wi-Fi Direct	1.120	1.013	N/A	
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:		
					
Devin Chang Senior Engineer UL Verification Services Inc.			Coltyce Sanders Laboratory Engineer UL Verification Services Inc.		

2. Test Specification, Methods and Procedures

The tests documented in this report were performed in accordance with FCC 47 CFR § 2.1093, IEEE STD 1528-2013, the following FCC Published RF exposure KDB procedures, 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 D02 HSPA and 1x Advanced v02r02
- 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 Measurement for 802 11abgn 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. The full scope of accreditation can be viewed at <http://ts.nist.gov/standards/scopes/2000650.htm>.

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

System Check

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

Others

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Power Meter	Agilent	N1912A	MY53040015	7/10/2015
Power Sensor	Agilent	N1921A	MY52200012	9/26/2015
Base Station Simulator	R & S	CMW500	135393	7/3/2015

5. Measurement Uncertainty

Per KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg, the extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval.

6. Device Under Test (DUT) Information

6.1. DUT Description

Model: SM-A500S, SM-A500K, SM-A500L	
Device Dimension	Overall (Length x Width): 139 mm x 70 mm Overall Diagonal: 150 mm Display Diagonal: 127 mm
Battery Back Cover	Device has a non-removable back cover
Battery Options	Device contains a non-removal battery
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 GHz)
SIM Information	☒ Single SIM ☐ Dual SIM

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/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		
WCDMA (UMTS)	Bands V and II	UMTS Rel. 99 (Voice & Data) HSDPA HSUPA	100%
LTE (FDD)	Bands 5 and 17	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	32.25% (DH1), 66.68% (DH3), 77.52% (DH5)

6.3. Nominal and Maximum Output Power

Tolerance (dB): -1.5 ~ 0.5		RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit
GSM1900	Voice	30.0	30.5
	GPRS 1 slot	30.0	30.5
	GPRS 2 slots	28.0	28.5
	GPRS 3 slots	27.0	27.5
	GPRS 4 slots	24.0	24.5
W-CDMA Band V	R99	22.5	23.0
	HSDPA	22.0	22.5
	HSUPA	22.0	22.5
W-CDMA Band II	R99	23.0	23.5
	HSDPA	22.0	22.5
	HSUPA	22.0	22.5
LTE Band 5	QPSK	23.0	23.5
LTE Band 17	QPSK	22.5	23.0
Tolerance (dB): 0.5		RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit
WiFi 2.4 GHz	802.11b	17.0	17.5
	802.11g	13.0	13.5
	802.11n HT20	12.0	12.5
WiFi 5 GHz	802.11a	13.0	13.5
	802.11n HT20	12.0	12.5
	802.11n HT40	11.0	11.5
Bluetooth		10.0	10.5
Bluetooth LE		5.0	5.5

6.4. Simultaneous Transmission Condition

RF Exposure Condition	Capable Transmit Configurations
Head	1. GSM 1900 Voice + Wi-Fi 2.4/5GHz 2. GSM 1900 (GPRS) + Wi-Fi 2.4/5GHz 3. WCDMA Band 2/5 + Wi-Fi 2.4/5GHz 4. LTE B5/17 + Wi-Fi 2.4/5GHz
Body-worn Accessory	1. GSM 1900 Voice + Wi-Fi 2.4/5GHz 2. GSM 1900 Voice + BT 3. GSM 1900 (GPRS) + Wi-Fi 2.4/5GHz 4. GSM 1900 (GPRS) + BT 5. WCDMA Band 2/5 + Wi-Fi 2.4/5GHz 6. WCDMA Band 2/5 + BT 7. LTE B5/17+ Wi-Fi 2.4/5GHz 8. LTE B5/17+ BT
Wireless Router (Hotspot)	1. GSM 1900 (GPRS) + Wi-Fi 2.4GHz 2. WCDMA Band 2/5 + Wi-Fi 2.4GHz 3. LTE B5/17+ Wi-Fi 2.4GHz
Notes: 1. Wi-Fi 2.4GHz supports Hotspot. 2. GPRS, 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 cannot 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 antenna and one (1) Diversity RX antenna Refer to "Photos and Antenna Locations" Appendix.																																												
Maximum power reduction (MPR)	Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3 <table border="1"> <thead> <tr> <th rowspan="2">Modulation</th><th colspan="6">Channel bandwidth / Transmission bandwidth (RB)</th><th rowspan="2">MPR (dB)</th></tr> <tr> <th>1.4 MHz</th><th>3.0 MHz</th><th>5 MHz</th><th>10 MHz</th><th>15 MHz</th><th>20 MHz</th></tr> </thead> <tbody> <tr> <td>QPSK</td><td>> 5</td><td>> 4</td><td>> 8</td><td>> 12</td><td>> 16</td><td>> 18</td><td>≤ 1</td></tr> <tr> <td>16 QAM</td><td>≤ 5</td><td>≤ 4</td><td>≤ 8</td><td>≤ 12</td><td>≤ 16</td><td>≤ 18</td><td>≤ 1</td></tr> <tr> <td>16 QAM</td><td>> 5</td><td>> 4</td><td>> 8</td><td>> 12</td><td>> 16</td><td>> 18</td><td>≤ 2</td></tr> </tbody> </table> 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.

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 / Wi-Fi Direct	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.

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	29.7	20.6
				661	1880.0	30.1	21.0
				810	1909.8	30.1	21.1
	GPRS (GMSK)	CS1	1	512	1850.2	29.7	20.7
				661	1880.0	30.1	21.1
				810	1909.8	30.1	21.1
			2	512	1850.2	28.0	21.9
				661	1880.0	28.0	22.0
				810	1909.8	28.0	22.0
			3	512	1850.2	27.0	22.8
				661	1880.0	27.3	23.0
				810	1909.8	27.4	23.1
			4	512	1850.2	24.3	21.3
				661	1880.0	24.5	21.4
				810	1909.8	24.4	21.3

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 3 time slots, based on the output power measurements above
- SAR is not required for EGPRS (8PSK) mode because it is Rx only.

8.2. WCDMA 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)
WCDMA Band V	Rel 99 (RMC, 12.2 kbps)	4132	826.4	22.2
		4183	836.6	22.4
		4233	846.6	22.4
WCDMA Band II	Rel 99 (RMC, 12.2 kbps)	9262	1852.4	23.1
		9400	1880.0	23.1
		9538	1907.6	23.2

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	
	Subtest	1	2	3	4
WCDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set 1			
	Power Control Algorithm	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	11/15	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			
	Abs= β_{hs}/β_c	30/15			

Measured Results

Band	Mode	UL Ch No.	Freq. (MHz)	MPR	Avg Pwr (dBm)
WCDMA Band V	Subtest 1	4132	826.4	0	21.2
		4183	836.6	0	21.3
		4233	846.6	0	21.4
	Subtest 2	4132	826.4	0	21.2
		4183	836.6	0	21.3
		4233	846.6	0	21.3
	Subtest 3	4132	826.4	0.5	20.5
		4183	836.6	0.5	20.7
		4233	846.6	0.5	20.8
	Subtest 4	4132	826.4	0.5	20.8
		4183	836.6	0.5	20.9
		4233	846.6	0.5	20.8
WCDMA Band II	Subtest 1	9262	1852.4	0	21.2
		9400	1880.0	0	21.2
		9538	1907.6	0	21.5
	Subtest 2	9262	1852.4	0	21.2
		9400	1880.0	0	21.5
		9538	1907.6	0	21.3
	Subtest 3	9262	1852.4	0.5	21.2
		9400	1880.0	0.5	21.3
		9538	1907.6	0.5	21.3
	Subtest 4	9262	1852.4	0.5	21.3
		9400	1880.0	0.5	21.0
		9538	1907.6	0.5	21.1

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

Measured Results

Band	Mode	UL Ch No.	Freq. (MHz)	MPR	Avg Pwr (dBm)
WCDMA Band V	Subtest 1	4132	826.4	0	21.0
		4183	836.6	0	21.3
		4233	846.6	0	21.2
	Subtest 2	4132	826.4	2	19.6
		4183	836.6	2	19.7
		4233	846.6	2	19.7
	Subtest 3	4132	826.4	1	20.1
		4183	836.6	1	20.3
		4233	846.6	1	20.3
	Subtest 4	4132	826.4	2	20.0
		4183	836.6	2	20.4
		4233	846.6	2	20.5
	Subtest 5	4132	826.4	0	21.2
		4183	836.6	0	21.3
		4233	846.6	0	21.2
WCDMA Band II	Subtest 1	9262	1852.4	0	20.6
		9400	1880.0	0	20.5
		9538	1907.6	0	21.1
	Subtest 2	9262	1852.4	2	20.2
		9400	1880.0	2	20.2
		9538	1907.6	2	20.2
	Subtest 3	9262	1852.4	1	20.8
		9400	1880.0	1	20.7
		9538	1907.6	1	20.8
	Subtest 4	9262	1852.4	2	20.4
		9400	1880.0	2	20.4
		9538	1907.6	2	20.4
	Subtest 5	9262	1852.4	0	21.2
		9400	1880.0	0	21.3
		9538	1907.6	0	21.3

8.3. LTE Band 5 and 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 Signaling Value of "NS_01".

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

Network Signalling value	Requirements (sub-clause)	E-UTRA Band	Channel bandwidth (MHz)	Resources Blocks (N_{RB})	A-MPR (dB)
NS_01	6.6.2.1.1	Table 5.5-1	1.4, 3, 5, 10, 15, 20	Table 5.6-1	NA
NS_03	6.6.2.2.1	2, 4, 10, 23, 25, 35, 36	3	>5	≤ 1
			5	>6	≤ 1
			10	>6	≤ 1
			15	>8	≤ 1
			20	>10	≤ 1
NS_04	6.6.2.2.2	41	5	>6	≤ 1
			10, 15, 20	See Table 6.2.4-4	
NS_05	6.6.3.3.1	1	10, 15, 20	≥ 50	≤ 1
NS_06	6.6.2.2.3	12, 13, 14, 17	1.4, 3, 5, 10	Table 5.6-1	n/a
NS_07	6.6.2.2.3 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)		
							20450	20525	20600
							829 MHz	836.5 MHz	844 MHz
LTE Band 5	10	QPSK	1	0	0	0	23.2	23.3	23.3
			1	24	0	0	23.3	23.2	23.2
			1	49	0	0	23.1	23.1	23.0
			25	0	1	1	22.3	22.3	22.2
			25	12	1	1	22.2	22.3	22.2
			25	24	1	1	22.3	22.2	22.2
			50	0	1	1	22.3	22.3	22.1
		16QAM	1	0	1	1	22.3	22.3	22.1
			1	24	1	1	22.1	22.2	22.0
			1	49	1	1	22.5	22.3	22.1
			25	0	2	2	21.2	21.3	21.3
			25	12	2	2	21.2	21.3	21.3
			25	24	2	2	21.2	21.3	21.3
			50	0	2	2	21.2	21.3	21.2
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							20425	20525	20625
							826.5 MHz	836.5 MHz	846.5 MHz
LTE Band 5	5	QPSK	1	0	0	0	23.0	23.4	23.3
			1	12	0	0	23.0	23.3	23.5
			1	24	0	0	23.0	23.2	23.0
			12	0	1	1	22.1	22.3	22.3
			12	6	1	1	22.2	22.2	22.1
			12	11	1	1	22.3	22.2	22.1
			25	0	1	1	22.3	22.3	22.2
		16QAM	1	0	1	1	22.3	22.5	22.5
			1	12	1	1	22.4	22.5	22.5
			1	24	1	1	22.4	22.3	22.5
			12	0	2	2	21.2	21.4	21.3
			12	6	2	2	21.2	21.3	21.2
			12	11	2	2	21.3	21.3	21.1
			25	0	2	2	21.3	21.3	21.2
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							20415	20525	20635
							825.5 MHz	836.5 MHz	847.5 MHz
LTE Band 5	3	QPSK	1	0	0	0	23.1	23.0	23.1
			1	7	0	0	23.3	23.4	23.4
			1	14	0	0	23.1	23.1	23.0
			6	0	1	1	22.2	22.3	22.0
			6	3	1	1	22.1	22.2	22.0
			6	5	1	1	22.0	22.2	22.2
			15	0	1	1	22.1	22.3	22.0
		16QAM	1	0	1	1	22.4	22.5	22.2
			1	7	1	1	22.4	22.2	22.4
			1	14	1	1	22.2	22.5	22.4
			6	0	2	2	21.2	21.3	21.2
			6	3	2	2	21.2	21.0	21.2
			6	5	2	2	21.1	21.0	21.4
			15	0	2	2	21.2	21.3	21.1

LTE Band 5 Measured Results (continued)

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							20407	20525	20643
							824.7 MHz	836.5 MHz	848.3 MHz
LTE Band 5	1.4	QPSK	1	0	0	0	23.1	23.1	23.0
			1	2	0	0	23.2	23.2	23.1
			1	5	0	0	23.2	23.1	23.0
			3	0	0	0	23.2	23.1	23.2
			3	1	0	0	23.1	23.2	23.2
			3	2	0	0	23.1	23.1	23.2
			6	0	1	1	22.1	22.1	22.1
		16QAM	1	0	1	1	22.5	22.5	22.4
			1	2	1	1	22.5	22.5	22.3
			1	5	1	1	22.5	22.5	22.0
			3	0	1	1	22.0	22.0	22.1
			3	1	1	1	22.0	22.1	22.2
			3	2	1	1	22.1	22.1	22.5
			6	0	2	2	21.4	21.1	21.4

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	22.67
			1	25	0	0	22.33
			1	49	0	0	22.48
			25	0	1	1	21.49
			25	12	1	1	21.52
			25	25	1	1	21.54
			50	0	1	1	21.49
		16QAM	1	0	1	1	22.00
			1	25	1	1	22.00
			1	49	1	1	21.75
			25	0	2	2	20.49
			25	12	2	2	20.57
			25	25	2	2	20.61
			50	0	2	2	20.49
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	1	22.02
			1	12	0	0	22.63
			1	24	0	0	22.36
			12	0	1	1	21.34
			12	6	1	1	21.45
			12	11	1	1	21.43
			25	0	1	1	21.44
		16QAM	1	0	1	1	21.18
			1	12	1	1	21.67
			1	24	1	1	21.17
			12	0	2	2	20.44
			12	6	2	2	20.58
			12	11	2	2	20.57
			25	0	2	2	20.64

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	17.2	Yes
			6	2437	17.1	
			11	2462	17.5	
	802.11g	6 Mbps	1	2412	13.3	No
			6	2437	13.5	
			11	2462	13.2	
	802.11n (HT20)	MCS0	1	2412	12.3	No
			6	2437	12.5	
			11	2462	12.2	

Note(s):

- Per KDB 248227 D01, SAR is not required for 802.11g/n 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	17.1	Yes
			2 Mbps	17.0	No
			5.5 Mbps	17.0	No
			11 Mbps	17.0	No

8.5. Wi-Fi (5 GHz Bands)

Required Test Channels per KDB 248227 D01

Measured Results

Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	Avg Pwr (dBm)	SAR Test (Yes/No)
5.2 (U-NII-1)	802.11a	6 Mbps	36	5180	13.5	Yes
			40	5200	13.2	
			44	5220	13.1	
			48	5240	13.0	
	802.11n (HT20)	6.5 Mbps	36	5180	12.1	No
			40	5200	12.0	
			48	5240	12.0	
	802.11n (HT40)	13.5 Mbps	38	5190	10.7	No
			46	5230	11.2	
5.3 (U-NII-2A)	802.11a	6 Mbps	52	5260	13.0	Yes
			56	5280	13.0	
			60	5300	13.1	
			64	5320	13.0	
	802.11n (HT20)	6.5 Mbps	52	5260	12.2	No
			60	5300	11.8	
			64	5320	12.0	
	802.11n (HT40)	13.5 Mbps	54	5270	11.0	No
			62	5310	10.9	
5.5 (U-NII-2C)	802.11a	6 Mbps	100	5500	13.3	Yes
			104	5520	13.0	
			108	5540	12.9	
			112	5560	13.4	
			116	5580	13.1	
			120	5600	13.1	
			124	5620	13.1	
			128	5640	13.5	
			132	5660	13.0	
			136	5680	12.9	
			140	5700	13.0	
	802.11n (HT20)	6.5 Mbps	100	5500	12.1	No
			116	5580	12.0	
			140	5700	12.0	
	802.11n (HT40)	13.5 Mbps	102	5510	11.1	No
			110	5550	11.2	
			134	5670	11.1	
5.8 (U-NII-3)	802.11a	6 Mbps	149	5745	13.2	Yes
			153	5765	13.2	
			157	5785	12.7	
			161	5805	12.9	
			165	5825	13.0	
	802.11n (HT20)	6.5 Mbps	149	5745	12.2	No
			157	5785	11.8	
			161	5805	12.0	
	802.11n (HT40)	13.5 Mbps	151	5755	11.3	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 (U-NII-1)	802.11a	36	5180	6 Mbps	13.5	Yes
				9 Mbps	13.5	No
				12 Mbps	13.4	No
				18 Mbps	13.2	No
				24 Mbps	13.0	No
				36 Mbps	12.6	No
				48 Mbps	12.3	No
				54 Mbps	12.2	No
5.3 GHz (U-NII-2A)	802.11a	52	5260	6 Mbps	13.0	Yes
				9 Mbps	13.0	No
				12 Mbps	13.0	No
				18 Mbps	12.9	No
				24 Mbps	12.7	No
				36 Mbps	12.3	No
				48 Mbps	12.0	No
				54 Mbps	11.9	No
5.5 GHz (U-NII-2C)	802.11a	100	5500	6 Mbps	13.3	Yes
				9 Mbps	13.1	No
				12 Mbps	13.0	No
				18 Mbps	12.7	No
				24 Mbps	12.5	No
				36 Mbps	12.2	No
				48 Mbps	11.8	No
				54 Mbps	11.6	No
5.8 GHz (U-NII-3)	802.11a	149	5745	6 Mbps	13.2	Yes
				9 Mbps	13.2	No
				12 Mbps	13.1	No
				18 Mbps	12.6	No
				24 Mbps	12.4	No
				36 Mbps	12.0	No
				48 Mbps	11.6	No
				54 Mbps	11.5	No

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 1

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
11/10/2014	Head 2450	e'	37.8800	Relative Permittivity (ϵ_r):	37.88	39.20	-3.37	5
		e''	13.6800	Conductivity (σ):	1.86	1.80	3.53	5
	Head 2410	e'	38.0700	Relative Permittivity (ϵ_r):	38.07	39.28	-3.08	5
		e''	13.5700	Conductivity (σ):	1.82	1.76	3.29	5
	Head 2475	e'	37.7500	Relative Permittivity (ϵ_r):	37.75	39.17	-3.62	5
		e''	13.7700	Conductivity (σ):	1.89	1.83	3.72	5
11/10/2014	Body 2450	e'	50.5100	Relative Permittivity (ϵ_r):	50.51	52.70	-4.16	5
		e''	14.6400	Conductivity (σ):	1.99	1.95	2.28	5
	Body 2410	e'	50.6900	Relative Permittivity (ϵ_r):	50.69	52.76	-3.92	5
		e''	14.5100	Conductivity (σ):	1.94	1.91	1.94	5
	Body 2475	e'	50.4200	Relative Permittivity (ϵ_r):	50.42	52.67	-4.27	5
		e''	14.7900	Conductivity (σ):	2.04	1.99	2.53	5
11/12/2014	Head 750	e'	41.0400	Relative Permittivity (ϵ_r):	41.04	41.96	-2.20	5
		e''	22.0000	Conductivity (σ):	0.92	0.89	2.73	5
	Head 700	e'	41.8200	Relative Permittivity (ϵ_r):	41.82	42.22	-0.94	5
		e''	22.4500	Conductivity (σ):	0.87	0.89	-1.73	5
	Head 710	e'	41.5200	Relative Permittivity (ϵ_r):	41.52	42.17	-1.53	5
		e''	22.3300	Conductivity (σ):	0.88	0.89	-0.95	5
11/12/2014	Body 750	e'	54.6900	Relative Permittivity (ϵ_r):	54.69	55.55	-1.54	5
		e''	23.4900	Conductivity (σ):	0.98	0.96	1.71	5
	Body 700	e'	55.2100	Relative Permittivity (ϵ_r):	55.21	55.74	-0.95	5
		e''	23.9700	Conductivity (σ):	0.93	0.96	-2.74	5
	Body 710	e'	55.0400	Relative Permittivity (ϵ_r):	55.04	55.70	-1.18	5
		e''	23.8400	Conductivity (σ):	0.94	0.96	-1.96	5

SAR Lab 2

Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)	
11/11/2014	Head 835	e'	41.4500	Relative Permittivity (ε _r):	41.45	41.50	-0.12	5
		e"	19.7100	Conductivity (σ):	0.92	0.90	1.68	5
	Head 820	e'	41.6700	Relative Permittivity (ε _r):	41.67	41.60	0.16	5
		e"	19.8000	Conductivity (σ):	0.90	0.90	0.48	5
	Head 850	e'	41.2300	Relative Permittivity (ε _r):	41.23	41.50	-0.65	5
		e"	19.7300	Conductivity (σ):	0.93	0.92	1.91	5
11/11/2014	Body 835	e'	55.2900	Relative Permittivity (ε _r):	55.29	55.20	0.16	5
		e"	21.8900	Conductivity (σ):	1.02	0.97	4.78	5
	Body 820	e'	55.5300	Relative Permittivity (ε _r):	55.53	55.28	0.46	5
		e"	21.9500	Conductivity (σ):	1.00	0.97	3.34	5
	Body 850	e'	55.1700	Relative Permittivity (ε _r):	55.17	55.16	0.02	5
		e"	21.8000	Conductivity (σ):	1.03	0.99	4.37	5

SAR Lab 3

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
11/10/2014	Head 1850	e'	39.3400	Relative Permittivity (ϵ_r):	39.34	40.00	-1.65	5
		e''	13.4500	Conductivity (σ):	1.38	1.40	-1.18	5
	Head 1900	e'	39.1900	Relative Permittivity (ϵ_r):	39.19	40.00	-2.03	5
		e''	13.5900	Conductivity (σ):	1.44	1.40	2.55	5
	Head 1910	e'	39.1600	Relative Permittivity (ϵ_r):	39.16	40.00	-2.10	5
		e''	13.6100	Conductivity (σ):	1.45	1.40	3.24	5
11/10/2014	Body 1850	e'	53.1500	Relative Permittivity (ϵ_r):	53.15	53.30	-0.28	5
		e''	15.0200	Conductivity (σ):	1.55	1.52	1.65	5
	Body 1900	e'	53.1300	Relative Permittivity (ϵ_r):	53.13	53.30	-0.32	5
		e''	15.0300	Conductivity (σ):	1.59	1.52	4.46	5
	Body 1910	e'	53.0700	Relative Permittivity (ϵ_r):	53.07	53.30	-0.43	5
		e''	15.0200	Conductivity (σ):	1.60	1.52	4.94	5

SAR Lab 5

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
11/10/2014	Head 5180	e'	37.7000	Relative Permittivity (ϵ_r):	37.70	36.01	4.68	5
		e"	15.4500	Conductivity (σ):	4.45	4.63	-3.90	5
	Head 5200	e'	37.6600	Relative Permittivity (ϵ_r):	37.66	35.99	4.64	5
		e"	15.4900	Conductivity (σ):	4.48	4.65	-3.70	5
	Head 5600	e'	37.1700	Relative Permittivity (ϵ_r):	37.17	35.53	4.60	5
		e"	15.8000	Conductivity (σ):	4.92	5.06	-2.78	5
	Head 5800	e'	37.0400	Relative Permittivity (ϵ_r):	37.04	35.30	4.93	5
		e"	15.9800	Conductivity (σ):	5.15	5.27	-2.21	5
	Head 5825	e'	36.9200	Relative Permittivity (ϵ_r):	36.92	35.30	4.59	5
		e"	15.8700	Conductivity (σ):	5.14	5.27	-2.46	5
11/10/2014	Body 5180	e'	47.3500	Relative Permittivity (ϵ_r):	47.35	49.05	-3.46	5
		e"	18.3300	Conductivity (σ):	5.28	5.27	0.15	5
	Body 5200	e'	47.3600	Relative Permittivity (ϵ_r):	47.36	49.02	-3.39	5
		e"	18.3200	Conductivity (σ):	5.30	5.29	0.04	5
	Body 5600	e'	46.8000	Relative Permittivity (ϵ_r):	46.80	48.48	-3.46	5
		e"	18.9100	Conductivity (σ):	5.89	5.76	2.21	5
	Body 5800	e'	46.7600	Relative Permittivity (ϵ_r):	46.76	48.20	-2.99	5
		e"	19.2100	Conductivity (σ):	6.20	6.00	3.25	5
	Body 5825	e'	46.5400	Relative Permittivity (ϵ_r):	46.54	48.20	-3.44	5
		e"	19.1100	Conductivity (σ):	6.19	6.00	3.16	5
11/14/2014	Head 5180	e'	37.4500	Relative Permittivity (ϵ_r):	37.45	36.01	3.99	5
		e"	15.5500	Conductivity (σ):	4.48	4.63	-3.28	5
	Head 5200	e'	37.4400	Relative Permittivity (ϵ_r):	37.44	35.99	4.03	5
		e"	15.6200	Conductivity (σ):	4.52	4.65	-2.90	5
	Head 5600	e'	37.0400	Relative Permittivity (ϵ_r):	37.04	35.53	4.24	5
		e"	15.7800	Conductivity (σ):	4.91	5.06	-2.90	5
	Head 5800	e'	36.6700	Relative Permittivity (ϵ_r):	36.67	35.30	3.88	5
		e"	15.9900	Conductivity (σ):	5.16	5.27	-2.15	5
	Head 5825	e'	36.7100	Relative Permittivity (ϵ_r):	36.71	35.30	3.99	5
		e"	15.9600	Conductivity (σ):	5.17	5.27	-1.91	5
11/14/2014	Body 5180	e'	47.3100	Relative Permittivity (ϵ_r):	47.31	49.05	-3.54	5
		e"	18.6700	Conductivity (σ):	5.38	5.27	2.01	5
	Body 5200	e'	47.3000	Relative Permittivity (ϵ_r):	47.30	49.02	-3.51	5
		e"	18.7100	Conductivity (σ):	5.41	5.29	2.17	5
	Body 5600	e'	46.8500	Relative Permittivity (ϵ_r):	46.85	48.48	-3.36	5
		e"	19.0500	Conductivity (σ):	5.93	5.76	2.96	5
	Body 5800	e'	46.3200	Relative Permittivity (ϵ_r):	46.32	48.20	-3.90	5
		e"	19.3300	Conductivity (σ):	6.23	6.00	3.90	5
Body 5825	e'	46.4600	Relative Permittivity (ϵ_r):	46.46	48.20	-3.61	5	
	e"	19.2800	Conductivity (σ):	6.24	6.00	4.08	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	1019	3/17/2014	750	1g	8.21	8.64
				10g	5.38	5.69
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 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			
11/12/2014	D750V3	1019	Head	1g	0.82	8.2	8.21	-0.73	
				10g	0.53	5.3	5.38	-0.93	
11/12/2014	D750V3	1019	Body	1g	0.89	8.9	8.64	2.66	1,2
				10g	0.59	5.9	5.69	3.87	
11/10/2014	D2450V2	706	Head	1g	5.46	54.6	53.00	3.02	
				10g	2.47	24.7	24.50	0.82	
11/10/2014	D2450V2	706	Body	1g	5.25	52.5	50.20	4.58	3,4
				10g	2.43	24.3	23.40	3.85	

SAR Lab 2

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			
11/11/2014	D835V2	4d117	Head	1g	0.978	9.8	9.23	5.96	5,6
				10g	0.641	6.4	5.98	7.19	
11/11/2014	D835V2	4d117	Body	1g	0.991	9.9	9.61	3.12	
				10g	0.656	6.6	6.31	3.96	

SAR Lab 3

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			
11/10/2014	D1900V2	5d163	Head	1g	3.90	39.0	40.80	-4.41	7,8
				10g	2.03	20.3	21.20	-4.25	
11/10/2014	D1900V2	5d163	Body	1g	4.02	40.2	40.60	-0.99	
				10g	2.08	20.8	21.40	-2.80	

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			
11/10/2014	5200	1003	Head	1g	8.05	80.5	77.70	3.60
				10g	2.33	23.3	22.20	4.95
11/10/2014	5200	1003	Body	1g	7.82	78.2	73.50	6.39
				10g	2.20	22.0	20.50	7.32
11/14/2014	5200	1003	Head	1g	8.18	81.8	77.70	5.28
				10g	2.37	23.7	22.20	6.76
11/14/2014	5200	1003	Body	1g	7.84	78.4	73.50	6.67
				10g	2.22	22.2	20.50	8.29
11/10/2014	5600	1003	Head	1g	8.87	88.7	81.80	8.44
				10g	2.52	25.2	23.20	8.62
11/10/2014	5600	1003	Body	1g	8.62	86.2	79.60	8.29
				10g	2.40	24.0	22.10	8.60
11/14/2014	5600	1003	Head	1g	8.29	82.9	81.80	1.34
				10g	2.35	23.5	23.20	1.29
11/14/2014	5600	1003	Body	1g	8.19	81.9	79.60	2.89
				10g	2.28	22.8	22.10	3.17
11/10/2014	5800	1003	Head	1g	8.31	83.1	78.30	6.13
				10g	2.37	23.7	22.10	7.24
11/10/2014	5800	1003	Body	1g	7.73	77.3	73.80	4.74
				10g	2.16	21.6	20.40	5.88
11/14/2014	5800	1003	Head	1g	8.32	83.2	78.30	6.26
				10g	2.37	23.7	22.10	7.24
11/14/2014	5800	1003	Body	1g	7.63	76.3	73.80	3.39
				10g	2.14	21.4	20.40	4.90

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.

KDB 248227 D01 SAR Measurements Procedures for 802.11 a/b/g Transmitters v01r02 (pg.6):

Each channel should be tested at the lowest data rate in each a-b/g mode or 4.9 GHz channel BW configuration.

When the extrapolated maximum peak SAR for the maximum output channel is ≤ 1.6 W/kg and the 1-g averaged SAR is ≤ 0.8 W/kg, testing of other channels in the "default test channels" or "required test channels" configuration is optional.

11.1. GSM1900

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Voice	0	Left Touch	661	1880.0	30.5	30.1	0.230	0.252	1
			Left Tilt	661	1880.0	30.5	30.1	0.046	0.050	
			Right Touch	661	1880.0	30.5	30.1	0.171	0.187	
			Right Tilt	661	1880.0	30.5	30.1	0.086	0.094	
Head VoIP	GPRS 3 Slots	0	Left Touch	661	1880.0	27.5	27.3	0.188	0.197	2
			Left Tilt	661	1880.0	27.5	27.3	0.038	0.040	
			Right Touch	661	1880.0	27.5	27.3	0.145	0.152	
			Right Tilt	661	1880.0	27.5	27.3	0.073	0.076	
Body-worn	Voice	10	Rear	512	1850.2	30.5	29.7	0.733	0.881	
				661	1880.0	30.5	30.1	0.777	0.852	
				810	1909.8	30.5	30.1	0.834	0.914	
			Front	512	1850.2	30.5	29.7	0.733	0.881	
				661	1880.0	30.5	30.1	0.803	0.880	
				810	1909.8	30.5	30.1	0.865	0.948	3
Body-worn(VoIP) & Hotspot	GPRS 3 Slots	10	Rear	661	1880.0	27.5	27.3	0.562	0.588	
Front			661	1880.0	27.5	27.3	0.614	0.643	4	
Hotspot			Edge 2	661	1880.0	27.5	27.3	0.117	0.123	
			Edge 3	661	1880.0	27.5	27.3	0.658	0.689	5
			Edge 4	661	1880.0	27.5	27.3	0.157	0.164	

11.2. WCDMA Band V

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Rel 99 RMC	0	Left Touch	4183	836.6	23.0	22.4	0.148	0.170	6
			Left Tilt	4183	836.6	23.0	22.4	0.100	0.115	
			Right Touch	4183	836.6	23.0	22.4	0.147	0.169	
			Right Tilt	4183	836.6	23.0	22.4	0.103	0.118	
Body-worn & Hotspot	Rel 99 RMC	10	Rear	4183	836.6	23.0	22.4	0.249	0.286	7
			Front	4183	836.6	23.0	22.4	0.229	0.263	
Hotspot	Rel 99 RMC	10	Edge 2	4183	836.6	23.0	22.4	0.144	0.165	
			Edge 3	4183	836.6	23.0	22.4	0.069	0.079	
			Edge 4	4183	836.6	23.0	22.4	0.123	0.141	

11.3. WCDMA Band II

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Rel 99 RMC	0	Left Touch	9400	1880.0	23.5	23.1	0.294	0.322	8
			Left Tilt	9400	1880.0	23.5	23.1	0.048	0.053	
			Right Touch	9400	1880.0	23.5	23.1	0.174	0.191	
			Right Tilt	9400	1880.0	23.5	23.1	0.076	0.083	
Body-worn & Hotspot	Rel 99 RMC	10	Rear	9400	1880.0	23.5	23.1	0.699	0.766	
			Front	9262	1852.4	23.5	23.1	0.693	0.760	
				9400	1880.0	23.5	23.1	0.787	0.863	
				9538	1907.6	23.5	23.2	0.834	0.894	9
Hotspot	Rel 99 RMC	10	Edge 2	9400	1880.0	23.5	23.1	0.158	0.173	
			Edge 3	9262	1852.4	23.5	23.1	0.962	1.055	10
				9400	1880.0	23.5	23.1	0.890	0.976	
				9538	1907.6	23.5	23.2	0.861	0.923	
			Edge 4	9400	1880.0	23.5	23.1	0.210	0.230	

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)		Plot No.
								Tune-up limit	Meas.	Meas.	Scaled	
Head	QPSK	0	Left Touch	20525	836.5	1	0	23.5	23.3	0.167	0.175	11
						25	0	22.5	22.3	0.128	0.134	
			Left Tilt	20525	836.5	1	0	23.5	23.3	0.105	0.110	
						25	0	22.5	22.3	0.082	0.086	
			Right Touch	20525	836.5	1	0	23.5	23.3	0.174	0.182	
						25	0	22.5	22.3	0.131	0.137	
Body-worn & Hotspot	QPSK	10	Rear	20525	836.5	1	0	23.5	23.3	0.312	0.327	12
						25	0	22.5	22.3	0.233	0.244	
			Front	20525	836.5	1	0	23.5	23.3	0.270	0.283	
						25	0	22.5	22.3	0.207	0.217	
Hotspot	QPSK	10	Edge 2	20525	836.5	1	0	23.5	23.3	0.150	0.157	
						25	0	22.5	22.3	0.124	0.130	
			Edge 3	20525	836.5	1	0	23.5	23.3	0.071	0.074	
						25	0	22.5	22.3	0.055	0.058	
			Edge 4	20525	836.5	1	0	23.5	23.3	0.168	0.176	
						25	0	22.5	22.3	0.128	0.134	

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)		Plot No.
								Tune-up limit	Meas.	Meas.	Scaled	
Head	QPSK	0	Left Touch	23790	710.0	1	0	23.0	22.7	0.016	0.017	13
						25	0	22.0	21.5	0.011	0.012	
			Left Tilt	23790	710.0	1	0	23.0	22.7	0.003	0.003	
						25	0	22.0	21.5	0.001	0.001	
			Right Touch	23790	710.0	1	0	23.0	22.7	0.011	0.012	
						25	0	22.0	21.5	0.007	0.008	
Body-worn & Hotspot	QPSK	10	Rear	23790	710.0	1	0	23.0	22.7	0.064	0.069	14
						25	0	22.0	21.5	0.046	0.052	
			Front	23790	710.0	1	0	23.0	22.7	0.091	0.098	
						25	0	22.0	21.5	0.059	0.066	
Hotspot	QPSK	10	Edge 2	23790	710.0	1	0	23.0	22.7	0.013	0.014	
						25	0	22.0	21.5	0.009	0.010	
			Edge 3	23790	710.0	1	0	23.0	22.7	0.018	0.019	
						25	0	22.0	21.5	0.013	0.015	
			Edge 4	23790	710.0	1	0	23.0	22.7	0.024	0.026	
						25	0	22.0	21.5	0.018	0.020	

11.6. Wi-Fi (DTS Band)

Frequency Band	RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
							Tune-up limit	Meas.	Meas.	Scaled	
2.4 GHz	Head	802.11b 1 Mbps	0	Left Touch	6	2437.0	17.5	17.1	0.426	0.467	15
				Left Tilt	6	2437.0	17.5	17.1	0.313	0.343	
				Right Touch	6	2437.0	17.5	17.1	0.270	0.296	
				Right Tilt	6	2437.0	17.5	17.1	0.185	0.203	
	Body-worn & Hotspot	802.11b 1 Mbps	10	Rear	6	2437.0	17.5	17.1	0.061	0.067	16
				Front	6	2437.0	17.5	17.1	0.059	0.065	
	Hotspot	802.11b 1 Mbps	10	Edge 1	6	2437.0	17.5	17.1	0.039	0.043	
				Edge 2	6	2437.0	17.5	17.1	0.013	0.014	

11.7. Wi-Fi (UNII Band)

Frequency Band	RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
							Tune-up limit	Meas.	Meas.	Scaled	
5.2 GHz (U-NII-1)	Head	802.11a 6 Mbps	0	Left Touch	36	5180	13.5	13.5	0.451	0.451	17
				Left Tilt	36	5180	13.5	13.5	0.323	0.323	
				Right Touch	36	5180	13.5	13.5	0.141	0.141	
				Right Tilt	36	5180	13.5	13.5	0.114	0.114	
	Body-worn	802.11a 6 Mbps	10	Rear	36	5180	13.5	13.5	0.110	0.110	18
				Front	36	5180	13.5	13.5	0.024	0.024	
Frequency Band	RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
							Tune-up limit	Meas.	Meas.	Scaled	
5.3 GHz (U-NII-2A)	Head	802.11a 6 Mbps	0	Left Touch	60	5300	13.5	13.1	0.703	0.771	19
				Left Tilt	60	5300	13.5	13.1	0.445	0.488	
				Right Touch	60	5300	13.5	13.1	0.252	0.276	
				Right Tilt	60	5300	13.5	13.1	0.221	0.242	
	Body-worn	802.11a 6 Mbps	10	Rear	60	5300	13.5	13.1	0.108	0.118	20
				Front	60	5300	13.5	13.1	0.026	0.029	
Frequency Band	RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
							Tune-up limit	Meas.	Meas.	Scaled	
5.5 GHz (U-NII-2C)	Head	802.11a 6 Mbps	0	Left Touch	128	5640	13.5	13.5	0.492	0.492	21
				Left Tilt	128	5640	13.5	13.5	0.335	0.335	
				Right Touch	128	5640	13.5	13.5	0.173	0.173	
				Right Tilt	128	5640	13.5	13.5	0.139	0.139	
	Body-worn	802.11a 6 Mbps	10	Rear	128	5640	13.5	13.5	0.042	0.042	22
				Front	128	5640	13.5	13.5	0.006	0.006	
Frequency Band	RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
							Tune-up limit	Meas.	Meas.	Scaled	
5.8 GHz (U-NII-3)	Head	802.11a 6 Mbps	0	Left Touch	149	5745	13.5	13.2	0.749	0.803	
					157	5785	13.5	12.7	0.922	1.108	23
					165	5825	13.5	13.0	0.944	1.059	
				Left Tilt	149	5745	13.5	13.2	0.498	0.534	
				Right Touch	149	5745	13.5	13.2	0.371	0.398	
				Right Tilt	149	5745	13.5	13.2	0.325	0.348	
	Body-worn	802.11a 6 Mbps	10	Rear	149	5745	13.5	13.2	0.192	0.206	24
				Front	149	5745	13.5	13.2	0.026	0.028	

11.8. Bluetooth

11.8.1. Bluetooth Maximum Power

Maximum tune-up tolerance limit is 10.5 dBm. This power level qualifies for exclusion of SAR testing. Refer to Standalone SAR Test Exclusion Considerations Section below.

11.8.2. 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)			
10.5	11	10	2.480	1.7

Conclusion:

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

11.8.3. 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	11	10	2.480	0.236

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).

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)/Wi-Fi Direct (W/kg)	Repeated SAR (Yes/No)
750	LTE Band 17		0.091		No
850	WCDMA Band V				
	LTE Band 5		0.312		No
1900	GSM 1900				
	WCDMA Band II			0.962	Yes
2400	Wi-Fi 802.11b/g/n	0.426			No
5200	Wi-Fi 802.11a/n	0.451			No
5300	Wi-Fi 802.11a/n	0.703			No
5500	Wi-Fi 802.11a/n	0.492			No
5800	Wi-Fi 802.11a/n	0.944			Yes

12.2. Repeated Measurement Results

Head

Frequency band	Test Position	Antenna	Mode	Ch #.	Freq. (MHz)	Meas. SAR (W/kg)		Largest to Smallest SAR Ratio	Note
						Original	Repeated		
UNII Band-3	Left Touch	Wi-Fi	802.11a 6 Mbps	165	5825	0.944	0.903	1.05	1

Body-worn Accessory

N/A

Wireless Router (Hotspot)

Frequency band	Test Position	Antenna	Mode	Ch #.	Freq. (MHz)	Meas. SAR (W/kg)		Largest to Smallest SAR Ratio	Note
						Original	Repeated		
WCDMA Band II	Edge 3	Main	Rel.99 RMC	9262	1852.4	0.962	0.947	1.02	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

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	0.252	0.467		0.719	No
		① + ③	0.252	1.108		1.360	No
	Left Tilt	① + ②	0.050	0.343		0.393	No
		① + ③	0.050	0.534		0.584	No
	Right Touch	① + ②	0.187	0.296		0.483	No
		① + ③	0.187	0.398		0.585	No
	Right Tilt	① + ②	0.094	0.203		0.297	No
		① + ③	0.094	0.348		0.442	No
Body-worn Accessory & Hotspot	Rear	① + ②	0.914	0.067		0.981	No
		① + ③	0.914	0.206		1.120	No
		① + ④	0.914		0.236	1.150	No
	Front	① + ②	0.948	0.065		1.013	No
		① + ③	0.948	0.029		0.977	No
		① + ④	0.948		0.236	1.184	No
Hotspot	Edge 1	① + ②		0.043		0.043	No
	Edge 2	① + ②	0.123	0.014		0.137	No
	Edge 3	① + ②	0.689			0.689	No
	Edge 4	① + ②	0.164			0.164	No

13.2. 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 Band V	② Wi-Fi(DTS)	③ Wi-Fi(UNII)	④ Bluetooth		
Head	Left Touch	① + ②	0.170	0.467		0.637	No
		① + ③	0.170	1.108		1.278	No
	Left Tilt	① + ②	0.115	0.343		0.458	No
		① + ③	0.115	0.534		0.649	No
	Right Touch	① + ②	0.169	0.296		0.465	No
		① + ③	0.169	0.398		0.567	No
	Right Tilt	① + ②	0.118	0.203		0.321	No
		① + ③	0.118	0.348		0.466	No
Body-worn Accessory & Hotspot	Rear	① + ②	0.286	0.067		0.353	No
		① + ③	0.286	0.206		0.492	No
		① + ④	0.286		0.236	0.522	No
	Front	① + ②	0.263	0.065		0.328	No
		① + ③	0.263	0.029		0.292	No
		① + ④	0.263		0.236	0.499	No
Hotspot	Edge 1	① + ②		0.043		0.043	No
	Edge 2	① + ②	0.165	0.014		0.179	No
	Edge 3	① + ②	0.079			0.079	No
	Edge 4	① + ②	0.141			0.141	No

13.3. 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 Band II	② Wi-Fi(DTS)	③ Wi-Fi(UNII)	④ Bluetooth		
Head	Left Touch	① + ②	0.322	0.467			0.789	No
		① + ③	0.322		1.108		1.430	No
	Left Tilt	① + ②	0.053	0.343			0.396	No
		① + ③	0.053		0.534		0.587	No
	Right Touch	① + ②	0.191	0.296			0.487	No
		① + ③	0.191		0.398		0.589	No
	Right Tilt	① + ②	0.083	0.203			0.286	No
		① + ③	0.083		0.348		0.431	No
Body-worn Accessory & Hotspot	Rear	① + ②	0.766	0.067			0.833	No
		① + ③	0.766		0.206		0.972	No
		① + ④	0.766			0.236	1.002	No
	Front	① + ②	0.894	0.065			0.959	No
		① + ③	0.894		0.029		0.923	No
		① + ④	0.894			0.236	1.130	No
Hotspot	Edge 1	① + ②		0.043			0.043	No
	Edge 2	① + ②	0.173	0.014			0.187	No
	Edge 3	① + ②	1.055				1.055	No
	Edge 4	① + ②	0.230				0.230	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	0.175	0.467			0.642	No
		① + ③	0.175		1.108		1.283	No
	Left Tilt	① + ②	0.110	0.343			0.453	No
		① + ③	0.110		0.534		0.644	No
	Right Touch	① + ②	0.182	0.296			0.478	No
		① + ③	0.182		0.398		0.580	No
	Right Tilt	① + ②	0.112	0.203			0.315	No
		① + ③	0.112		0.348		0.460	No
Body-worn Accessory & Hotspot	Rear	① + ②	0.327	0.067			0.394	No
		① + ③	0.327		0.206		0.533	No
		① + ④	0.327			0.236	0.563	No
	Front	① + ②	0.283	0.065			0.348	No
		① + ③	0.283		0.029		0.312	No
		① + ④	0.283			0.236	0.519	No
Hotspot	Edge 1	① + ②		0.043			0.043	No
	Edge 2	① + ②	0.157	0.014			0.171	No
	Edge 3	① + ②	0.074				0.074	No
	Edge 4	① + ②	0.176				0.176	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	0.017	0.467			0.484	No
		① + ③	0.017		1.108		1.125	No
	Left Tilt	① + ②	0.003	0.343			0.346	No
		① + ③	0.003		0.534		0.537	No
	Right Touch	① + ②	0.012	0.296			0.308	No
		① + ③	0.012		0.398		0.410	No
	Right Tilt	① + ②	0.002	0.203			0.205	No
		① + ③	0.002		0.348		0.350	No
Body-worn Accessory & Hotspot	Rear	① + ②	0.069	0.067			0.136	No
		① + ③	0.069		0.206		0.275	No
		① + ④	0.069			0.236	0.305	No
	Front	① + ②	0.098	0.065			0.163	No
		① + ③	0.098		0.029		0.127	No
		① + ④	0.098			0.236	0.334	No
Hotspot	Edge 1	① + ②		0.043			0.043	No
	Edge 2	① + ②	0.014	0.014			0.028	No
	Edge 3	① + ②	0.019				0.019	No
	Edge 4	① + ②	0.026				0.026	No

Conclusion:

Simultaneous transmission SAR measurement (Volume Scan) is not required because the sum of the 1-g SAR is < 1.6 W/kg.

14. Appendixes

Refer to separated files for the following appendixes.

- A. Photos and Antenna Locations**
- B. System Performance Check Plots**
- C. Highest SAR Test Plots**
- D. Tissue Material Ingredients**
- E. Calibration Certificates for E-Field Probes**
- F. Calibration Certificates for Dipoles**

END OF REPORT