



SAR EVALUATION REPORT

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

For
GSM/WCDMA Phone + Bluetooth and WLAN 2.4GHz b/g/n

**Model: SM-G530BT
FCC ID: A3LSMG530BT**

**Report Number: 14I18664-S1
Issue Date: 9/12/2014**

Prepared for
**Samsung Electronics Co., Ltd.
416, Maetan 3-Dong, Yeongtong-Gu
Suwon-City, GyeonGggi-Do 443-742, South Korea**

Prepared by
**UL VERIFICATION SERVICES INC.
47173 BENICIA STREET
FREMONT, CA 94538, U.S.A.
TEL: (510) 771-1000
FAX: (510) 661-0888**



NVLAP LAB CODE 200065-0

REVISION HISTORY



Rev.	Issue Date	Revisions	Revised By
--	09/12/2014	Initial Issue	--

Table of Contents

1.	Attestation of Test Results	5
2.	Test Specification, Methods and Procedures.....	6
3.	Facilities and Accreditation	6
4.	SAR Measurement System & Test Equipment	7
4.1.	<i>SAR Measurement System.....</i>	7
4.2.	<i>SAR Scan Procedure.....</i>	8
4.3.	<i>Test Equipment.....</i>	10
5.	Measurement Uncertainty.....	11
6.	Device Under Test (DUT) Information	12
6.1.	<i>DUT Description</i>	12
6.2.	<i>Wireless Technologies.....</i>	13
6.3.	<i>Nominal and Maximum Output Power.....</i>	14
6.4.	<i>Simultaneous Transmission Condition</i>	15
7.	RF Exposure Conditions (Test Configurations)	16
7.1.	<i>Head.....</i>	16
7.2.	<i>Body-worn Accessory</i>	16
7.3.	<i>Wireless Router (Hotspot).....</i>	16
8.	Conducted Output Power Measurements.....	17
8.1.	<i>GSM850 and GSM1900.....</i>	17
8.2.	<i>W-CDMA Band V and II</i>	19
8.3.	<i>Wi-Fi (2.4 GHz Band).....</i>	23
8.4.	<i>Bluetooth</i>	23
9.	Dielectric Property Measurements.....	24
9.1.	<i>Tissue Dielectric Parameters</i>	24
9.2.	<i>Dielectric Property Measurements Results</i>	25
10.	System Check.....	26
10.1.	<i>Reference Target SAR Values</i>	26
10.2.	<i>System Check Results</i>	26
11.	Measured and Reported (Scaled) SAR Results.....	27
11.1.	<i>GSM850.....</i>	28
11.2.	<i>GSM1900.....</i>	28
11.3.	<i>W-CDMA Band V</i>	29
11.4.	<i>W-CDMA Band II.....</i>	29

11.5.	<i>Wi-Fi (DTS Band)</i>	29
11.6.	<i>Bluetooth</i>	30
11.6.1.	<i>Standalone SAR Test Exclusion Considerations</i>	30
11.6.2.	<i>Estimated SAR</i>	30
12.	SAR Measurement Variability	31
12.1.	<i>The Highest Measured SAR Configuration in Each Frequency Band</i>	31
13.	Simultaneous Transmission SAR Analysis	32
13.1.	<i>Sum of the SAR for GSM850 & Wi-Fi & BT</i>	32
13.2.	<i>Sum of the SAR for GSM1900 & Wi-Fi & BT</i>	32
13.3.	<i>Sum of the SAR for WCDMA Band V & Wi-Fi & BT</i>	33
13.4.	<i>Sum of the SAR for WCDMA Band II & Wi-Fi & BT</i>	33
14.	Appendixes	34
14.1.	<i>Photos and Antenna Locations</i>	34
14.2.	<i>System Performance Check Plots</i>	34
14.3.	<i>Highest SAR Test Plots</i>	34
14.4.	<i>Calibration Certificate for E-Field Probe EX3DV4 - SN 3902</i>	34
14.5.	<i>Calibration Certificate for E-Field Probe EX3DV4 - SN 3991</i>	34
14.6.	<i>Calibration Certificate for D835V2 - SN 4d002</i>	34
14.7.	<i>Calibration Certificate for D1900V2- SN 5d163</i>	34
14.8.	<i>Calibration Certificate for D2450V2 - SN 899</i>	34

1. Attestation of Test Results

Applicant Name	Samsung Electronics		
Application Purpose	<input checked="" type="checkbox"/> Original Grant <input type="checkbox"/> Class II Permissive Change		
FCC ID	A3LSMG530BT		
DUT Description	GSM/WCDMA Phone + Bluetooth and WLAN 2.4GHz b/g/n		
Exposure Category	General Population/Uncontrolled Exposure (1g SAR limit: 1.6 W/kg)		
The Highest Reported SAR	RF Exposure Conditions	Equipment Class	
		Licensed	DTS
	Head	0.376 W/kg	0.247 W/kg
	Body-worn Accessory	0.773 W/kg	0.243 W/kg
	Wireless Router (Hotspot)		
	Wi-Fi Direct	N/A	
Simultaneous Transmission	Head: 0.559 W/kg	Body: 1.016 W/kg	
Applicable Standards	FCC 47 CFR § 2.1093 Published RF exposure KDB procedures IEEE Std 1528-2013		
Test Results	Pass		
Date tested	08/28/2014 – 09/05/2014		
<p>UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.</p> <p>Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government (NIST Handbook 150, Annex A). This report is written to support regulatory compliance of the applicable standards stated above.</p>			
Approved & Released By:  Dave Weaver Program Manager UL Verification Services Inc.		Prepared By:  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 1528-2003 & 2013, the following FCC Published RF exposure KDB procedures, and TCB workshop updates:

- 447498 D01 General RF Exposure Guidance v05r02
- 648474 D04 Handset SAR v01r02
- 941225 D01 SAR test for 3G devices v02
- 941225 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 D06 Hotspot Mode SAR v01r01
- 248227 D01 SAR Meas for 802 11abg v01r02
- 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r03
- 865664 D02 SAR Reporting v01r01
- 690783 D01 SAR Listings on Grants v01r03

3. Facilities and Accreditation

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

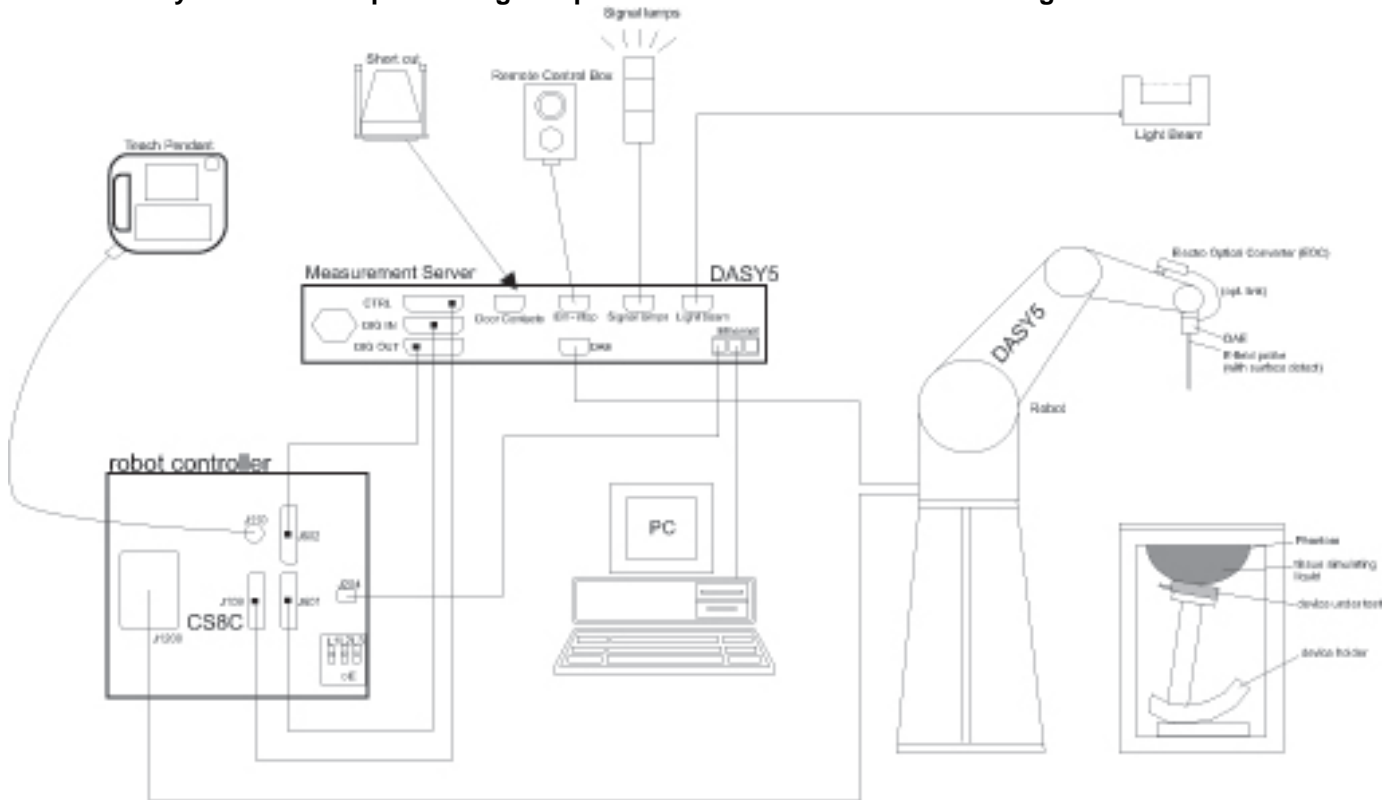
47173 Benicia Street	47266 Benicia Street
SAR Lab A	SAR Lab 1
SAR Lab B	SAR Lab 2
SAR Lab C	SAR Lab 3
SAR Lab D	SAR Lab 4
SAR Lab E	SAR Lab 5
SAR Lab F	
SAR Lab G	
SAR Lab H	

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://ts.nist.gov/standards/scopes/2000650.htm>.

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: Δx_{Area} , Δy_{Area}	≤ 2 GHz: ≤ 15 mm $2 - 3$ GHz: ≤ 12 mm	$3 - 4$ GHz: ≤ 12 mm $4 - 6$ GHz: ≤ 10 mm
	When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be \leq the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

Step 3: Zoom Scan

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

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

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

Step 4: Power drift measurement

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

Step 5: Z-Scan (FCC only)

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

4.3. Test Equipment

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

Dielectric Property Measurements

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Network Analyzer	Agilent	ENA Series/E5071B	MY42100131	2/24/2015
Dielectronic Probe kit	SPEAG	DAK-3.5	1087	11/13/2014
Dielectronic Probe kit	SPEAG	DAK-3.5 Short	SM DAK 200 BA	N/A
Thermometer	Control Company	4242	122529163	9/19/2014
Thermometer	EXTECH	445703	CCS-200	3/24/2015

System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
HP Signal Generator	HP	8665B	3546A00784	6/23/2015
Power Meter	HP	437B	3125U16345	6/16/2015
Power Meter	HP	437B	3125U09516	9/30/2014
Power Sensor	Agilent	8481A	2237A31744	10/2/2014
Power Sensor	Agilent	8481A	2349A36506	9/30/2014
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1808939	N/A
Bi-directional coupler	Werlatone, Inc.	C8060-102	2710	N/A
DC Power Supply	Sorensen Ametek	XT15-4	1319A02778	N/A
HP Signal Generator	HP	8665B	3438A00633	7/10/2015
Power Meter	HP	438A	3513U04320	10/2/2014
Power Sensor	Agilent	8481A	2702A66876	9/30/2014
Power Sensor	Agilent	8481A	3318A95392	9/30/2014
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1622052	N/A
Bi-directional coupler	Werlatone, Inc.	C8060-102	2711	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 5)	SPEAG	EX3DV4	3991	5/16/2015
Data Acquisition Electronics (SAR 1)	SPEAG	DAE3	427	1/21/2015
Data Acquisition Electronics (SAR 5)	SPEAG	DAE4	1439	5/14/2015
System Validation Dipole	SPEAG	D835V2	4d002	11/15/2014
System Validation Dipole	SPEAG	D1900V2	5d163	9/17/2014
System Validation Dipole	SPEAG	D2450V2	899	9/10/2014
Thermometer (SAR Lab 1)	EXTECH	445703	CCS-205	3/24/2015
Thermometer (SAR Lab 5)	EXTECH	445703	CCS-239	6/3/2015

Others

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Power Meter	Agilent	N1912A	MY53040015	7/10/2015
Power Sensor	Agilent	N1921A	MY52020011	5/6/2015
Base Station Simulator	R & S	CMW500	135393-VQ	7/3/2015
Base Station Simulator	R & S	CMW500	125236-eS	5/29/2015
Base Station Simulator	R & S	CMW500	127733-cy	6/2/2015

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

6. Device Under Test (DUT) Information

6.1. DUT Description

Model: A3LSMG530BT	
Device Dimension	Overall (Length x Width): 144 mm x 71 mm Overall Diagonal: 155 mm Display Diagonal: 128 mm
Battery Back Cover	<input checked="" type="checkbox"/> Normal Battery Cover <input type="checkbox"/> Normal Battery Cover with NFC <input type="checkbox"/> Wireless Charger Battery Cover <input type="checkbox"/> Wireless Charger Battery Cover with NFC.
Battery Options	<input checked="" type="checkbox"/> Standard – Lithium-ion battery, Rating 3.8Vdc, 9.88Wh <input type="checkbox"/> Extended (large capacity)
Accessory	Headset
Wireless Router (Hotspot)	Wi-Fi Hotspot mode permits the device to share its cellular data connection with other Wi-Fi-enabled devices. <input checked="" type="checkbox"/> Mobile Hotspot (Wi-Fi 2.4 GHz) <input type="checkbox"/> Mobile Hotspot (Wi-Fi 5 GHz)
Wi-Fi Direct	Wi-Fi Direct enabled devices transfer data directly between each other <input checked="" type="checkbox"/> Wi-Fi Direct (Wi-Fi 2.4 GHz) <input type="checkbox"/> Wi-Fi Direct (Wi-Fi 5 GHz)
SIM Information	<input type="checkbox"/> Single SIM <input checked="" type="checkbox"/> Dual SIM

6.2. Wireless Technologies

Wireless technologies	Frequency bands	Operating mode	Duty Cycle used for SAR testing
GSM	850, 1900	Voice (GMSK) GPRS (GMSK) EGPRS (8PSK)	GSM Voice: 12.5%; GPRS/EGPRS: 1 Slot: 12.5%; 2 Slots: 25%, 3 Slots: 37.5%, 4 Slots: 50%,
		GPRS Multi-Slot Class: <input type="checkbox"/> Class 8 - One Up <input type="checkbox"/> Class 10 - Two Up <input type="checkbox"/> Class 12 - Four Up <input checked="" type="checkbox"/> Class 33 - Four Up DTM (Dual Transfer Mode): Not supported	
W-CDMA (UMTS)	Band V and II	UMTS Rel. 99 (Voice & Data) HSDPA HSUPA	100%
Wi-Fi	2.4 GHz	802.11b 802.11g 802.11n (HT20)	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

Upper limit (dB): 0.5 ~ -1.5		RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit
GSM850	Voice	32.5	33.0
	GPRS 1 slot	32.5	33.0
	GPRS 2 slots	30.0	30.5
	GPRS 3 slots	28.5	29.0
	GPRS 4 slots	27.5	28.0
	EGPRS 1 slot	27.5	28.0
	EGPRS 2 slots	26.5	27.0
	EGPRS 3 slots	25.5	26.0
	EGPRS 4 slots	24.5	25.0
GSM1900	Voice	29.5	30.0
	GPRS 1 slot	29.5	30.0
	GPRS 2 slots	27.0	27.5
	GPRS 3 slots	25.0	25.5
	GPRS 4 slots	24.0	24.5
	EGPRS 1 slot	26.0	26.5
	EGPRS 2 slots	25.0	25.5
	EGPRS 3 slots	24.0	24.5
	EGPRS 4 slots	23.0	23.5
W-CDMA Band V	R99	22.5	23.0
	HSDPA	22.5	23.0
	HSUPA	22.5	23.0
W-CDMA Band II	R99	22.0	22.5
	HSDPA	22.0	22.5
	HSUPA	22.0	22.5

Upper limit (dB): 0.5		RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit
WiFi 2.4 GHz	802.11b	16.0	16.5
	802.11g	13.0	13.5
	802.11n HT20	12.0	12.5
Bluetooth		10.5	11.0
Bluetooth LE		1.5	2.0

6.4. Simultaneous Transmission Condition

RF Exposure Condition	Capable Transmit Configurations
Head	<ol style="list-style-type: none"> 1. GSM 850/1900 Voice + Wi-Fi 2.4GHz 2. GSM 850/1900 (GPRS/EDGE) + Wi-Fi 2.4GHz 3. WCDMA Band 2/5 + Wi-Fi 2.4GHz
Body-worn Accessory	<ol style="list-style-type: none"> 1. GSM 850/1900 Voice + Wi-Fi 2.4GHz 2. GSM 850/1900 Voice + BT 3. GSM 850/1900 (GPRS/EDGE) + Wi-Fi 2.4GHz 4. GSM 850/1900 (GPRS/EDGE) + BT 5. WCDMA Band 2/5 + Wi-Fi 2.4GHz 6. WCDMA Band 2/5 + BT
Wireless Router (Hotspot) and Wi-Fi Direct	<ol style="list-style-type: none"> 1. GSM 850/1900 (GPRS/EDGE) + Wi-Fi 2.4GHz 2. WCDMA Band 2/5 + Wi-Fi 2.4GHz
<p>Notes:</p> <ol style="list-style-type: none"> 1. Wi-Fi only 2.4GHz supports Hotspot and Wi-Fi Direct. 2. GPRS/EDGE and WCDMA support Hotspot. 3. VoIP is supported in WCDMA and GPRS. 4. Wi-Fi 2.4 GHz Radio cannot transmit simultaneously with Bluetooth Radio. 	

7. RF Exposure Conditions (Test Configurations)

Refer to “Photos and Antenna Locations” Appendix for the specific details of the antenna-to-antenna and antenna-to-edge(s) distances.

7.1. Head

For WWAN and Wi-Fi

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

7.2. Body-worn Accessory

For WWAN

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

For Wi-Fi

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

7.3. Wireless Router (Hotspot)

For WWAN

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	<25 mm	Yes	
Front	<25 mm	Yes	
Edge 1 (Top)	129 mm	No	SAR is not required because the distance from the antenna to the edge is > 25 mm as per KDB 941225 D06 Hot Spot SAR
Edge 2 (Right)	10 mm	Yes	
Edge 3 (Bottom)	3.5 mm	Yes	
Edge 4 (Left)	1 mm	Yes	

For Wi-Fi

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	<25 mm	Yes	
Front	<25 mm	Yes	
Edge 1 (Top)	25 mm	Yes	
Edge 2 (Right)	64 mm	No	SAR is not required because the distance from the antenna to the edge is > 25 mm as per KDB 941225 D06 Hot Spot SAR
Edge 3 (Bottom)	107 mm	No	SAR is not required because the distance from the antenna to the edge is > 25 mm as per KDB 941225 D06 Hot Spot SAR
Edge 4 (Left)	3 mm	Yes	

8. Conducted Output Power Measurements

8.1. GSM850 and GSM1900

GSM850 Measured Results

Band	Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Burst Pwr (dBm)	Frame Pwr (dBm)	
850	GSM (Voice)	CS1	1	128	824.2	32.4	23.4	
				190	836.6	32.5	23.5	
				251	848.8	32.7	23.7	
	GPRS (GMSK)	CS1	1	1	128	824.2	32.4	23.4
					190	836.6	32.5	23.4
					251	848.8	32.8	23.7
			2	1	128	824.2	30.4	24.3
					190	836.6	30.4	24.4
					251	848.8	30.5	24.5
			3	1	128	824.2	28.4	24.1
					190	836.6	28.5	24.2
					251	848.8	28.7	24.5
			4	1	128	824.2	27.5	24.5
					190	836.6	27.5	24.5
					251	848.8	27.7	24.7
	EGPRS (8PSK)	MCS5	1	1	128	824.2	27.8	18.7
					190	836.6	27.8	18.7
					251	848.8	27.9	18.9
			2	1	128	824.2	26.4	20.4
					190	836.6	26.5	20.4
					251	848.8	26.6	20.5
			3	1	128	824.2	25.5	21.2
					190	836.6	25.3	21.1
					251	848.8	25.6	21.3
4			1	128	824.2	24.2	21.2	
				190	836.6	24.2	21.2	
				251	848.8	24.4	21.4	

Notes:

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

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

GSM1900 Measured Results

Band	Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Burst Pwr (dBm)	Frame Pwr (dBm)	
1900	GSM (Voice)	CS1	1	512	1850.2	30.0	20.9	
				661	1880.0	29.5	20.5	
				810	1909.8	29.6	20.6	
	GPRS (GMSK)	CS1	1	1	512	1850.2	30.0	20.9
					661	1880.0	29.5	20.5
					810	1909.8	29.6	20.6
			2	1	512	1850.2	27.5	21.5
					661	1880.0	27.4	21.4
					810	1909.8	27.5	21.5
			3	1	512	1850.2	25.5	21.2
					661	1880.0	25.4	21.1
					810	1909.8	25.5	21.2
			4	1	512	1850.2	24.5	21.5
					661	1880.0	24.5	21.4
					810	1909.8	24.5	21.5
	EGPRS (8PSK)	MCS5	1	1	512	1850.2	26.5	17.5
					661	1880.0	26.4	17.4
					810	1909.8	26.5	17.5
			2	1	512	1850.2	25.5	19.5
					661	1880.0	25.1	19.1
					810	1909.8	25.2	19.2
			3	1	512	1850.2	24.5	20.2
					661	1880.0	24.1	19.9
					810	1909.8	24.3	20.1
4			1	512	1850.2	23.5	20.5	
				661	1880.0	23.1	20.1	
				810	1909.8	23.4	20.4	

Notes:

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

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

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	22.2
		4183	836.6	22.2
		4233	846.6	22.3
W-CDMA Band II	Rel 99 (RMC, 12.2 kbps)	9262	1852.4	22.5
		9400	1880.0	22.2
		9538	1907.6	22.2

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

Measured Results

Band	Mode	UL Ch No.	Freq. (MHz)	MPR	Avg Pwr (dBm)
W-CDMA Band V	Subtest 1	4132	826.4	0	21.3
		4183	836.6	0	21.1
		4233	846.6	0	21.2
	Subtest 2	4132	826.4	0	21.8
		4183	836.6	0	21.9
		4233	846.6	0	21.7
	Subtest 3	4132	826.4	0.5	20.7
		4183	836.6	0.5	20.5
		4233	846.6	0.5	20.6
	Subtest 4	4132	826.4	0.5	20.5
		4183	836.6	0.5	20.8
		4233	846.6	0.5	20.9
W-CDMA Band II	Subtest 1	9262	1852.4	0	21.4
		9400	1880.0	0	21.2
		9538	1907.6	0	21.2
	Subtest 2	9262	1852.4	0	20.5
		9400	1880.0	0	20.5
		9538	1907.6	0	20.5
	Subtest 3	9262	1852.4	0.5	20.0
		9400	1880.0	0.5	20.0
		9538	1907.6	0.5	20.1
	Subtest 4	9262	1852.4	0.5	20.8
		9400	1880.0	0.5	20.8
		9538	1907.6	0.5	21.0

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)
W-CDMA Band V	Subtest 1	4132	826.4	0	21.3
		4183	836.6	0	21.5
		4233	846.6	0	21.4
	Subtest 2	4132	826.4	2	19.7
		4183	836.6	2	20.3
		4233	846.6	2	20.1
	Subtest 3	4132	826.4	1	20.8
		4183	836.6	1	20.2
		4233	846.6	1	20.4
	Subtest 4	4132	826.4	2	20.8
		4183	836.6	2	20.9
		4233	846.6	2	20.4
	Subtest 5	4132	826.4	0	21.3
		4183	836.6	0	21.5
		4233	846.6	0	21.4
W-CDMA Band II	Subtest 1	9262	1852.4	0	21.0
		9400	1880.0	0	21.3
		9538	1907.6	0	21.0
	Subtest 2	9262	1852.4	2	20.3
		9400	1880.0	2	20.2
		9538	1907.6	2	20.1
	Subtest 3	9262	1852.4	1	20.3
		9400	1880.0	1	20.0
		9538	1907.6	1	20.1
	Subtest 4	9262	1852.4	2	20.3
		9400	1880.0	2	19.9
		9538	1907.6	2	20.2
	Subtest 5	9262	1852.4	0	21.6
		9400	1880.0	0	21.2
		9538	1907.6	0	21.2

8.3. 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	16.5	Yes
			6	2437	16.5	
			11	2462	16.5	
	802.11g	6 Mbps	1	2412	13.3	No
			6	2437	13.4	
			11	2462	13.0	
	802.11n (HT20)	MCS0	1	2412	12.4	No
			6	2437	12.5	
			11	2462	12.0	

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	16.5	Yes
			2 Mbps	16.4	No
			5.5 Mbps	16.5	No
			11 Mbps	16.2	No

8.4. Bluetooth

Maximum tune-up tolerance limit is 11.0 dBm. This power level qualifies for exclusion of SAR testing. Refer to Standalone SAR Test Exclusion Considerations Section.

9. Dielectric Property Measurements

The temperature of the tissue-equivalent medium used during measurement must also be within 18°C to 25°C and within $\pm 2^\circ\text{C}$ of the temperature when the tissue parameters are characterized.

The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 3 – 4 days of use; or earlier if the dielectric parameters can become out of tolerance; for example, when the parameters are marginal at the beginning of the measurement series.

Tissue dielectric parameters were measured at the low, middle and high frequency of each operating frequency range of the test device.

9.1. Tissue Dielectric Parameters

FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

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

IEEE Std 1528-2013

Refer to Table 3 within the IEEE Std 1528-2013

9.2. Dielectric Property Measurements Results

The temperature of the tissue-equivalent medium used during measurement must also be within 18°C to 25°C and within $\pm 2^\circ\text{C}$ of the temperature when the tissue parameters are characterized.

The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 3 – 4 days of use; or earlier if the dielectric parameters can become out of tolerance; for example, when the parameters are marginal at the beginning of the measurement series.

Tissue dielectric parameters were measured at the low, middle and high frequency of each operating frequency range of the test device.

SAR Lab 1

Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit \pm (%)	
9/2/2014	Body 2450	e'	52.4400	Relative Permittivity (ϵ_r):	52.44	52.70	-0.49	5
		e"	14.9900	Conductivity (σ):	2.04	1.95	4.72	5
	Body 2410	e'	52.6400	Relative Permittivity (ϵ_r):	52.64	52.76	-0.23	5
		e"	14.8100	Conductivity (σ):	1.98	1.91	4.04	5
	Body 2475	e'	52.3500	Relative Permittivity (ϵ_r):	52.35	52.67	-0.60	5
		e"	15.0900	Conductivity (σ):	2.08	1.99	4.61	5

SAR Lab 5

Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit \pm (%)	
9/2/2014	Head 835	e'	41.9900	Relative Permittivity (ϵ_r):	41.99	41.50	1.18	5
		e"	20.0900	Conductivity (σ):	0.93	0.90	3.64	5
	Head 820	e'	42.2700	Relative Permittivity (ϵ_r):	42.27	41.60	1.60	5
		e"	20.1100	Conductivity (σ):	0.92	0.90	2.05	5
	Head 850	e'	41.7900	Relative Permittivity (ϵ_r):	41.79	41.50	0.70	5
		e"	20.0900	Conductivity (σ):	0.95	0.92	3.77	5
9/2/2014	Body 835	e'	52.7800	Relative Permittivity (ϵ_r):	52.78	55.20	-4.38	5
		e"	21.9200	Conductivity (σ):	1.02	0.97	4.92	5
	Body 820	e'	52.9000	Relative Permittivity (ϵ_r):	52.90	55.28	-4.30	5
		e"	22.0000	Conductivity (σ):	1.00	0.97	3.57	5
	Body 850	e'	52.6400	Relative Permittivity (ϵ_r):	52.64	55.16	-4.56	5
		e"	21.8200	Conductivity (σ):	1.03	0.99	4.47	5
9/3/2014	Head 1900	e'	39.2800	Relative Permittivity (ϵ_r):	39.28	40.00	-1.80	5
		e"	13.3300	Conductivity (σ):	1.41	1.40	0.59	5
	Head 1850	e'	39.4900	Relative Permittivity (ϵ_r):	39.49	40.00	-1.28	5
		e"	13.1900	Conductivity (σ):	1.36	1.40	-3.09	5
	Head 1910	e'	39.2400	Relative Permittivity (ϵ_r):	39.24	40.00	-1.90	5
		e"	13.3600	Conductivity (σ):	1.42	1.40	1.35	5
9/3/2014	Body 1900	e'	51.3100	Relative Permittivity (ϵ_r):	51.31	53.30	-3.73	5
		e"	14.2800	Conductivity (σ):	1.51	1.52	-0.75	5
	Body 1850	e'	51.4900	Relative Permittivity (ϵ_r):	51.49	53.30	-3.40	5
		e"	14.1200	Conductivity (σ):	1.45	1.52	-4.44	5
	Body 1910	e'	51.2700	Relative Permittivity (ϵ_r):	51.27	53.30	-3.81	5
		e"	14.3200	Conductivity (σ):	1.52	1.52	0.05	5
8/28/2014	Head 2450	e'	37.8000	Relative Permittivity (ϵ_r):	37.80	39.20	-3.57	5
		e"	13.7600	Conductivity (σ):	1.87	1.80	4.14	5
	Head 2410	e'	37.9600	Relative Permittivity (ϵ_r):	37.96	39.28	-3.36	5
		e"	13.6600	Conductivity (σ):	1.83	1.76	3.98	5
	Head 2475	e'	37.6900	Relative Permittivity (ϵ_r):	37.69	39.17	-3.77	5
		e"	13.8100	Conductivity (σ):	1.90	1.83	4.02	5

10. System Check

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

10.1. Reference Target SAR Values

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

System Dipole	Serial No.	Cal. Date	Freq. (MHz)	Target SAR Values (W/kg)		
				1g/10g	Head	Body
D835V2	4d002	11/15/2013	835	1g	9.49	9.43
				10g	6.18	6.21
D1900V2	5d163	9/17/2013	1900	1g	40.9	40.1
				10g	21.2	21.2
D2450V2	899	9/10/2013	2450	1g	51.3	49.7
				10g	23.9	23.3

10.2. System Check Results

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

SAR Lab 1

Date Tested	System Dipole		T.S. Liquid	Measured Results			Target (Ref. Value)	Delta $\pm 10\%$	Est./Zoom Ratio	Plot No.	
	Type	Serial #		Area Scan	Zoom Scan	Normalize to 1 W					
9/2/2014	D2450V2	899	Body	1g	5.39	5.45	54.5	49.70	9.66	-1.11	1,2
				10g	2.35	2.52	25.2	23.30	8.15		

SAR Lab 5

Date Tested	System Dipole		T.S. Liquid	Measured Results			Target (Ref. Value)	Delta $\pm 10\%$	Est./Zoom Ratio	Plot No.	
	Type	Serial #		Area Scan	Zoom Scan	Normalize to 1 W					
9/2/2014	D835V2	4d002	Head	1g	1.05	1.03	10.3	9.49	8.54	1.90	3,4
				10g	0.712	0.679	6.79	6.18	9.87		
9/2/2014	D835V2	4d002	Body	1g	1.04	1.03	10.2	9.43	8.17	0.96	
				10g	0.699	0.681	6.81	6.21	9.66		
9/3/2014	D1900V2	5d163	Head	1g	3.84	3.83	38.3	40.90	-6.36	0.26	5,6
				10g	2.03	1.98	19.8	21.20	-6.60		
9/3/2014	D1900V2	5d163	Body	1g	4.05	4.01	40.1	40.10	0.00	0.99	
				10g	2.04	2.09	20.9	21.20	-1.42		
8/28/2014	D2450V2	899	Head	1g	5.59	5.26	52.6	51.30	2.53	5.90	7,8
				10g	2.45	2.38	23.8	23.90	-0.42		

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 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. GSM850

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Voice	0	Left Touch	190	836.6	33.0	32.5	0.202	0.227	1
			Left Tilt	190	836.6	33.0	32.5	0.120	0.135	
			Right Touch	190	836.6	33.0	32.5	0.192	0.215	
			Right Tilt	190	836.6	33.0	32.5	0.124	0.139	
Head VoIP	GPRS 4 Slots	0	Left Touch	190	836.6	28.0	27.5	0.335	0.376	2
			Left Tilt	190	836.6	28.0	27.5	0.197	0.221	
			Right Touch	190	836.6	28.0	27.5	0.278	0.312	
			Right Tilt	190	836.6	28.0	27.5	0.190	0.213	
Body-worn	Voice	10	Rear	190	836.6	33.0	32.5	0.399	0.448	3
			Front	190	836.6	33.0	32.5	0.268	0.301	
Body-worn(VoIP) & Hotspot	GPRS 4 Slots	10	Rear	190	836.6	28.0	27.5	0.638	0.716	4
Front			190	836.6	28.0	27.5	0.446	0.500		
Hotspot			Edge 2	190	836.6	28.0	27.5	0.340	0.381	
			Edge 3	190	836.6	28.0	27.5	0.056	0.063	
			Edge 4	190	836.6	28.0	27.5	0.530	0.595	

11.2. GSM1900

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Voice	0	Left Touch	512	1850.2	30.0	30.0	0.117	0.117	5
			Left Tilt	512	1850.2	30.0	30.0	0.043	0.043	
			Right Touch	512	1850.2	30.0	30.0	0.069	0.069	
			Right Tilt	512	1850.2	30.0	30.0	0.042	0.042	
Head VoIP	GPRS 4 Slots	0	Left Touch	512	1850.2	24.5	24.5	0.162	0.162	6
			Left Tilt	512	1850.2	24.5	24.5	0.057	0.057	
			Right Touch	512	1850.2	24.5	24.5	0.089	0.089	
			Right Tilt	512	1850.2	24.5	24.5	0.056	0.056	
Body-worn	Voice	10	Rear	512	1850.2	30.0	30.0	0.378	0.378	7
			Front	512	1850.2	30.0	30.0	0.343	0.343	
Body-worn(VoIP) & Hotspot	GPRS 4 Slots	10	Rear	512	1850.2	24.5	24.5	0.465	0.465	8
Front			512	1850.2	24.5	24.5	0.391	0.391		
Hotspot			Edge 2	512	1850.2	24.5	24.5	0.021	0.021	
			Edge 3	512	1850.2	24.5	24.5	0.356	0.356	
			Edge 4	512	1850.2	24.5	24.5	0.160	0.160	

11.3. W-CDMA Band V

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Rel 99 RMC	0	Left Touch	4183	836.6	23.0	22.2	0.254	0.305	9
			Left Tilt	4183	836.6	23.0	22.2	0.145	0.174	
			Right Touch	4183	836.6	23.0	22.2	0.198	0.238	
			Right Tilt	4183	836.6	23.0	22.2	0.136	0.164	
Body-worn & Hptspot	Rel 99 RMC	10	Rear	4183	836.6	23.0	22.2	0.415	0.499	10
			Front	4183	836.6	23.0	22.2	0.284	0.341	
Hotspot	Rel 99 RMC	10	Edge 2	4183	836.6	23.0	22.2	0.145	0.174	
			Edge 3	4183	836.6	23.0	22.2	0.041	0.049	
			Edge 4	4183	836.6	23.0	22.2	0.248	0.298	

11.4. W-CDMA Band II

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Rel 99 RMC	0	Left Touch	9400	1880.0	22.5	22.2	0.199	0.213	11
			Left Tilt	9400	1880.0	22.5	22.2	0.065	0.070	
			Right Touch	9400	1880.0	22.5	22.2	0.119	0.128	
			Right Tilt	9400	1880.0	22.5	22.2	0.065	0.070	
Body-worn & Hotspot	Rel 99 RMC	10	Rear	9400	1880.0	22.5	22.2	0.721	0.773	12
			Front	9400	1880.0	22.5	22.2	0.530	0.568	
Hotspot	Rel 99 RMC	10	Edge 2	9400	1880.0	22.5	22.2	0.025	0.027	
			Edge 3	9400	1880.0	22.5	22.2	0.406	0.435	
			Edge 4	9400	1880.0	22.5	22.2	0.207	0.222	

11.5. 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	16.5	16.5	0.096	0.096	
				Left Tilt	6	2437.0	16.5	16.5	0.091	0.091	
				Right Touch	6	2437.0	16.5	16.5	0.247	0.247	13
				Right Tilt	6	2437.0	16.5	16.5	0.123	0.123	
	Body-worn, Wi-Fi Direct & Hotspot	802.11b 1 Mbps	10	Rear	6	2437.0	16.5	16.5	0.243	0.243	14
				Front	6	2437.0	16.5	16.5	0.061	0.061	
	Hotspot & Wi-Fi Direct	802.11b 1 Mbps	10	Edge 1	6	2437.0	16.5	16.5	0.049	0.049	
				Edge 4	6	2437.0	16.5	16.5	0.160	0.160	

11.6. Bluetooth

11.6.1. 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.

11.6.2. 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:

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

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 v01. These additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

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

12.1. The Highest Measured SAR Configuration in Each Frequency Band

Frequency Band (MHz)	Air Interface	Head (W/kg)	Body-worn Accessory (W/kg)	Wireless Router (Hotspot) and Wi-Fi Direct (W/kg)	Repeated SAR (Yes/No)
850	GSM 850		0.638		No
	WCDMA Band V				
1900	GSM 1900				No
	WCDMA Band II		0.721		
2400	Wi-Fi 802.11b/g/n	0.247			No

Note(s):

1. No Measured SAR values >0.8W/kg therefore, no repeated SAR measurements are required.

13. Simultaneous Transmission SAR Analysis

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

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario			Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① GSM850	② Wi-Fi(DTS)	③ Bluetooth		
Head	Left Touch	① + ②	0.376	0.096		0.472	No
	Left Tilt	① + ②	0.221	0.091		0.312	No
	Right Touch	① + ②	0.312	0.247		0.559	No
	Right Tilt	① + ②	0.213	0.123		0.336	No
Body-worn Accessory & Hotspot	Rear	① + ②	0.716	0.243		0.959	No
		① + ③	0.716		0.273	0.989	No
	Front	① + ②	0.500	0.061		0.561	No
		① + ③	0.500		0.273	0.773	No
Hotspot	Edge 1	① + ②		0.049		0.049	No
	Edge 2	① + ②	0.381			0.381	No
	Edge 3	① + ②	0.063			0.063	No
	Edge 4	① + ②	0.595	0.160		0.755	No

SAR to Peak Location Separation Ratio (SPLSR)

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

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

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario			Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① GSM1900	② Wi-Fi(DTS)	③ Bluetooth		
Head	Left Touch	① + ②	0.162	0.096		0.258	No
	Left Tilt	① + ②	0.057	0.091		0.148	No
	Right Touch	① + ②	0.089	0.247		0.336	No
	Right Tilt	① + ②	0.056	0.123		0.179	No
Body-worn Accessory & Hotspot	Rear	① + ②	0.465	0.243		0.708	No
		① + ③	0.465		0.273	0.738	No
	Front	① + ②	0.391	0.061		0.452	No
		① + ③	0.391		0.273	0.664	No
Hotspot	Edge 1	① + ②		0.049		0.049	No
	Edge 2	① + ②	0.021			0.021	No
	Edge 3	① + ②	0.356			0.356	No
	Edge 4	① + ②	0.160	0.160		0.320	No

SAR to Peak Location Separation Ratio (SPLSR)

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

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

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario			Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① WCDMA Band V	② Wi-Fi(DTS)	③ Bluetooth		
Head	Left Touch	① + ②	0.305	0.096		0.401	No
	Left Tilt	① + ②	0.174	0.091		0.265	No
	Right Touch	① + ②	0.238	0.247		0.485	No
	Right Tilt	① + ②	0.164	0.123		0.287	No
Body-worn Accessory & Hotspot	Rear	① + ②	0.499	0.243		0.742	No
		① + ③	0.499		0.273	0.772	No
	Front	① + ②	0.341	0.061		0.402	No
		① + ③	0.341		0.273	0.614	No
Hotspot	Edge 1	① + ②		0.049		0.049	No
	Edge 2	① + ②	0.174			0.174	No
	Edge 3	① + ②	0.049			0.049	No
	Edge 4	① + ②	0.298	0.160		0.458	No

SAR to Peak Location Separation Ratio (SPLSR)

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

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

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario			Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① WCDMA Band II	② Wi-Fi(DTS)	③ Bluetooth		
Head	Left Touch	① + ②	0.213	0.096		0.309	No
	Left Tilt	① + ②	0.070	0.091		0.161	No
	Right Touch	① + ②	0.128	0.247		0.375	No
	Right Tilt	① + ②	0.070	0.123		0.193	No
Body-worn Accessory & Hotspot	Rear	① + ②	0.773	0.243		1.016	No
		① + ③	0.773		0.273	1.046	No
	Front	① + ②	0.568	0.061		0.629	No
		① + ③	0.568		0.273	0.841	No
Hotspot	Edge 1	① + ②		0.049		0.049	No
	Edge 2	① + ②	0.027			0.027	No
	Edge 3	① + ②	0.435			0.435	No
	Edge 4	① + ②	0.222	0.160		0.382	No

SAR to Peak Location Separation Ratio (SPLSR)

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

14. Appendixes

Refer to separated files for the following appendixes.

- 14.1. Photos and Antenna Locations**
- 14.2. System Performance Check Plots**
- 14.3. Highest SAR Test Plots**
- 14.4. Calibration Certificate for E-Field Probe EX3DV4 - SN 3902**
- 14.5. Calibration Certificate for E-Field Probe EX3DV4 - SN 3991**
- 14.6. Calibration Certificate for D835V2 - SN 4d002**
- 14.7. Calibration Certificate for D1900V2- SN 5d163**
- 14.8. Calibration Certificate for D2450V2 - SN 899**

END OF REPORT