SAR EVALUATION REPORT

FCC 47 CFR § 2.1093
IEEE Std 1528-2013

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

FCC ID: A3LSMG130BU
Model Name: SM-G130BU/DS

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Revision History

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1. Attestation of Test Results

Applicant Name		Samsung Electronics Co., Ltd.			
FCC ID		A3LSMG130BU			
Model Name		SM-G130BU/DS			
Applicable Standards		FCC 47 CFR § 2.1093 Published RF exposure KDB procedures IEEE Std 1528-2013			
SAR Limits (W/Kg)					
Exposure Category		Peak spatial-average (1g of tissue)			
General population / Uncontrolled exposure		1.6			
The Highest Reported SAR (W/kg)					
RF Exposure Conditions		**Equipment Class**			
		Licensed	**DTS**	**U-NII**	**DSS (BT)**
Head		0.957	0.219	N/A	N/A
Body-worn*		0.780	0.053		
Hotspot/Wi-Fi Direct		0.780	0.054		
Simultaneous TX	Head	1.059	1.059		
	Body-worn*	0.833	0.833		
	Hotspot/ Wi-Fi Direct	0.833	0.833		
Note: The Body-worn minimum separation distance is 15 mm. To cover both body-worn and hotspot RF exposure conditions testing was performed at a separation distance of 10 mm.					
Date Tested		1/5/2015 to 1/7/2015			
Test Results		Pass			

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government (NIST Handbook 150, Annex A). This report is written to support regulatory compliance of the applicable standards stated above.

Approved & Released By:	Prepared By:
	
Bobby Bayani Senior Engineer UL Verification Services Inc.	James Kim Laboratory Technician UL Verification Services Inc.

2. Test Specification, Methods and Procedures

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

- 248227 D01 SAR meas for 802.11abg v01r02
- 447498 D01 General RF Exposure Guidance v05r02
- 447498 D03 Supplement C Cross-Reference
- 648474 D04 Handset SAR v01r02
- 690783 D01 SAR Listings on Grants v01r03
- 865664 D01 SAR measurement 100 MHz to 6 GHz v01r03
- 865664 D02 RF Exposure Reporting v01r01
- 941225 D01 3G SAR Procedures v03
- 941225 D06 Hotspot Mode v02

3. Facilities and Accreditation

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

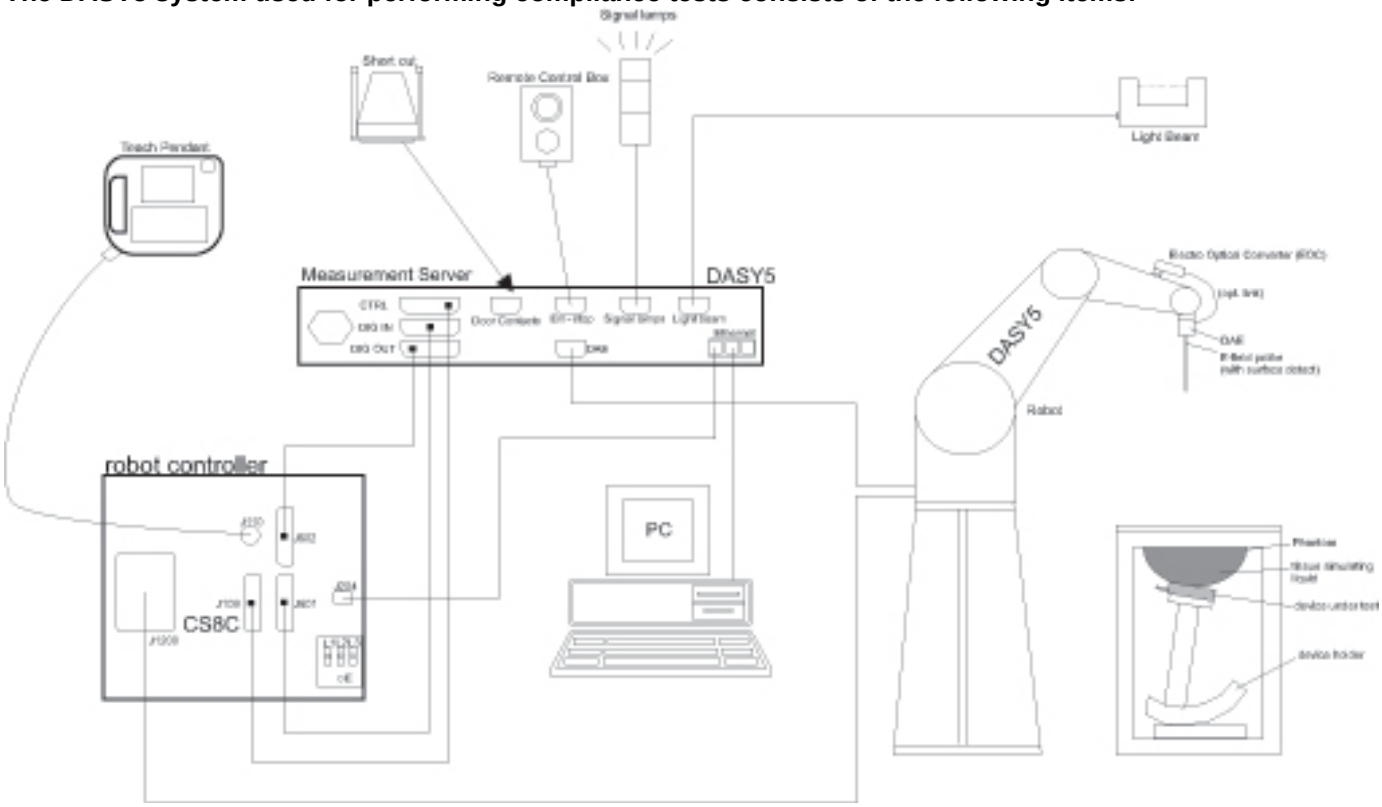
47173 Benicia Street	47266 Benicia Street
SAR Lab A	SAR Lab 1
SAR Lab B	SAR Lab 2
SAR Lab C	SAR Lab 3
SAR Lab D	SAR Lab 4
SAR Lab E	SAR Lab 5
SAR Lab F	
SAR Lab G	
SAR Lab H	

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0.

4. SAR Measurement System & Test Equipment

4.1. SAR Measurement System

The DASY5 system used for performing compliance tests consists of the following items:



- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic Field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running WinXP or Win7 and the DASY5 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

4.2. SAR Scan Procedures

Step 1: Power Reference Measurement

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

Step 2: Area Scan

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

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

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	½·δ·ln(2) ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ± 1°	20° ± 1°
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 ≤ 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: Δx_{Zoom}, Δy_{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 1st 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 *reported* SAR from the area scan based *1-g SAR estimation* procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.

Step 4: Power drift measurement

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

Step 5: Z-Scan (FCC only)

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

4.3. Test Equipment

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

Dielectric Property Measurements

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Network Analyzer	Agilent	8753ES	MY40001647	7/17/2015
Dielectronic Probe kit	SPEAG	DAK-3.5	1103	2/18/2015
Dielectronic Probe kit	SPEAG	DAK-3.5 Short	SM DAK 200 BA	N/A
Thermometer	Traceable Calibration Control Co.	4242	122529162	10/8/2015

System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Synthesized Signal Generator	HP	8665B	3744A01084	5/20/2015
Power Meter	Agilent	N1912A	MY53040016	5/5/2015
Power Sensor	Agilent	E9323A	MY53070005	5/1/2015
Power Sensor	Agilent	E9323A	MY53070009	5/28/2015
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1795093	N/A
Directional coupler	Werlatone	C8060-102	2149	N/A
DC Power Supply	AMETEK	XT 15-4	1319A02778	N/A
Synthesized Signal Generator	HP	8665B	3744A01155	3/12/2015
Power Meter	HP	437B	3125U11364	8/27/2015
Power Meter	HP	437B	3125U12345	8/15/2015
Power Sensor	HP	8481A	1926A27048	8/15/2015
Power Sensor	HP	8481A	2702A76223	9/17/2015
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1795092	N/A
Directional coupler	Werlatone	C8060-102	2141	N/A
DC Power Supply	BK PRECISION	1611	215-02292	N/A
E-Field Probe (SAR Lab B)	SPEAG	EX3DV4	3749	1/29/2015
E-Field Probe (SAR Lab E)	SPEAG	EX3DV4	3901	2/25/2015
E-Field Probe (SAR Lab G)	SPEAG	EX3DV4	3990	4/15/2015
Data Acquisition Electronics (SAR Lab B)	SPEAG	DAE3	500	5/15/2015
Data Acquisition Electronics (SAR Lab E)	SPEAG	DAE4	1357	2/17/2015
Data Acquisition Electronics (SAR Lab G)	SPEAG	DAE4	1434	4/14/2015
System Validation Dipole	SPEAG	D835V2	4d117	5/16/2015
System Validation Dipole	SPEAG	D1900V2	5d043	11/7/2015
System Validation Dipole	SPEAG	D2450V2	899	9/10/2015

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	132910-cp	4/25/2015

5. Measurement Uncertainty

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

6. Device Under Test (DUT) Information

6.1. DUT Description

Device Dimension	Overall (Length x Width): 108 mm x 57 mm Overall Diagonal: 117 mm Display Diagonal: 89 mm
Battery Back Cover	☒ Normal Battery Cover ☐ Normal Battery Cover with NFC ☐ Wireless Charger Battery Cover ☐ Wireless Charger Battery Cover with NFC ☐ The rechargeable battery is not user accessible.
Battery Options	☒ Standard – Lithium-ion battery, Rating 3.7Vdc, 4.81Wh ☐ Extended (large capacity) ☐ The rechargeable battery is not user accessible.
Accessory	Headset
Wireless Router (Hotspot)	Wi-Fi Hotspot mode permits the device to share its cellular data connection with other Wi-Fi-enabled devices. ☒ Mobile Hotspot (Wi-Fi 2.4 GHz) ☐ Mobile Hotspot (Wi-Fi 5 GHz)
Wi-Fi Direct	Wi-Fi Direct enabled devices transfer data directly between each other ☒ Wi-Fi Direct (Wi-Fi 2.4 GHz) ☐ Wi-Fi Direct (Wi-Fi 5 GHz)

6.2. Wireless Technologies

Wireless technologies	Frequency bands	Operating mode	Duty Cycle used for SAR testing
GSM	850 1900	Voice (GMSK) GPRS (GMSK)	GSM Voice: 12.5%; GPRS: 1 Slot: 12.5%; 2 Slots: 25%, 3 Slots: 37.5%, 4 Slots: 50%,
	GPRS Multi-Slot Class: ☐ Class 8 - One Up ☐ Class 10 - Two Up ☒ Class 12 - Four Up ☐ Class 33 - Four Up DTM (Dual Transfer Mode): Not support		
W-CDMA (UMTS)	Band V	UMTS Rel. 99 (Voice & Data) HSDPA (Rel. 5) HSUPA (Rel. 6)	100%
Wi-Fi	2.4 GHz	802.11b 802.11g 802.11n (HT20)	100%
Bluetooth	2.4 GHz	Version 4.0 LE	N/A

6.3. Nominal and Maximum Output Power

KDB 447498 sec.4.1.(3) at the maximum rated output power and within the tune-up tolerance range specified for the product, but not more than 2 dB lower than the maximum tune-up tolerance limit

Upper limit (dB): -1.5 ~ 0.5		RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit
GSM850	Voice	32.3	**32.8**
	GPRS 1 slot	32.1	**32.6**
	GPRS 2 slots	30.4	**30.9**
	GPRS 3 slots	28.6	**29.1**
	GPRS 4 slots	26.7	**27.2**
GSM1900	Voice	29.3	**29.8**
	GPRS 1 slot	28.8	**29.3**
	GPRS 2 slots	27.3	**27.8**
	GPRS 3 slots	25.8	**26.3**
	GPRS 4 slots	24.0	**24.5**
W-CDMA Band V	R99	22.5	**23.0**
	HSDPA	21.5	**22.0**
	HSUPA	21.5	**22.0**

Upper limit (dB): -1.5 ~ 0.5		RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit
WiFi 2.4 GHz	802.11b	13.5	**14.0**
	802.11g	11.0	**11.5**
	802.11n HT20	12.0	**12.5**
Bluetooth		9.0	**9.5**
Bluetooth LE		7.5	**8.0**

7. RF Exposure Conditions (Test Configurations)

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

Wireless technologies	RF Exposure Conditions	DUT-to-User Separation	Test Position	Antenna-to-edge/surface	SAR Required	Note
WWAN	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	15 mm	Rear	N/A	Yes	2
			Front	N/A	Yes	2
	Hotspot	10 mm	Rear	< 25 mm	Yes	
			Front	< 25 mm	Yes	
			Edge 1 (Top)	> 25 mm	No	1
			Edge 2 (Right)	< 25 mm	Yes	
			Edge 3 (Bottom)	< 25 mm	Yes	
			Edge 4 (Left)	< 25 mm	Yes	
WLAN	Head	0 mm	Left Touch	N/A	Yes	
			Left Tilt (15°)	N/A	Yes	
			Right Touch	N/A	Yes	
			Right Tilt (15°)	N/A	Yes	
	Body	15 mm	Rear	N/A	Yes	2
			Front	N/A	Yes	2
	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:

1. SAR is not required because the distance from the antenna to the edge is > 25 mm as per KDB 941225 D06 Hot Spot SAR.
2. The Body-worn minimum separation distance is 15 mm. To cover both body-worn and hotspot RF exposure conditions testing was performed at a separation distance of 10 mm.

8. Dielectric Property Measurements & System Check

8.1. Dielectric Property Measurements

The temperature of the tissue-equivalent medium used during measurement must also be within 18°C to 25°C and within ± 2°C of the temperature when the tissue parameters are characterized.
The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 3 – 4 days of use; or earlier if the dielectric parameters can become out of tolerance; for example, when the parameters are marginal at the beginning of the measurement series.
Tissue dielectric parameters were measured at the low, middle and high frequency of each operating frequency range of the test device.

Tissue Dielectric Parameters

FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

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

IEEE Std 1528-2013

Refer to Table 3 within the IEEE Std 1528-2013

Dielectric Property Measurements Results:

SAR Lab B

	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
1/5/2014	Head 2450	e'	38.5200	Relative Permittivity (ϵ_r):	38.52	39.20	-1.73	5
		e''	13.4700	Conductivity (σ):	1.83	1.80	1.94	5
	Head 2410	e'	38.6100	Relative Permittivity (ϵ_r):	38.61	39.28	-1.70	5
		e''	13.3900	Conductivity (σ):	1.79	1.76	1.92	5
	Head 2475	e'	38.4400	Relative Permittivity (ϵ_r):	38.44	39.17	-1.86	5
		e''	13.4200	Conductivity (σ):	1.85	1.83	1.08	5
1/5/2014	Body 2450	e'	50.8300	Relative Permittivity (ϵ_r):	50.83	52.70	-3.55	5
		e''	14.1400	Conductivity (σ):	1.93	1.95	-1.22	5
	Body 2410	e'	50.8700	Relative Permittivity (ϵ_r):	50.87	52.76	-3.58	5
		e''	14.1100	Conductivity (σ):	1.89	1.91	-0.87	5
	Body 2475	e'	50.7100	Relative Permittivity (ϵ_r):	50.71	52.67	-3.72	5
		e''	14.1400	Conductivity (σ):	1.95	1.99	-1.98	5

SAR Lab E

	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
1/6/2015	Body 1900	e'	51.9200	Relative Permittivity (ϵ_r):	51.92	53.30	-2.59	5
		e''	14.6800	Conductivity (σ):	1.55	1.52	2.03	5
	Body 1850	e'	51.9700	Relative Permittivity (ϵ_r):	51.97	53.30	-2.50	5
		e''	14.6700	Conductivity (σ):	1.51	1.52	-0.72	5
	Body 1910	e'	51.9200	Relative Permittivity (ϵ_r):	51.92	53.30	-2.59	5
		e''	14.6800	Conductivity (σ):	1.56	1.52	2.57	5
1/6/2015	Head 1900	e'	39.6400	Relative Permittivity (ϵ_r):	39.64	40.00	-0.90	5
		e''	13.7600	Conductivity (σ):	1.45	1.40	3.83	5
	Head 1850	e'	39.7100	Relative Permittivity (ϵ_r):	39.71	40.00	-0.72	5
		e''	13.8800	Conductivity (σ):	1.43	1.40	1.98	5
	Head 1910	e'	39.6000	Relative Permittivity (ϵ_r):	39.60	40.00	-1.00	5
		e''	13.6800	Conductivity (σ):	1.45	1.40	3.77	5

SAR Lab G

	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
1/6/2015	Body 835	e'	53.2400	Relative Permittivity (ϵ_r):	53.24	55.20	-3.55	5
		e''	21.8600	Conductivity (σ):	1.01	0.97	4.63	5
	Body 820	e'	53.4100	Relative Permittivity (ϵ_r):	53.41	55.28	-3.38	5
		e''	21.8200	Conductivity (σ):	0.99	0.97	2.73	5
	Body 850	e'	53.0600	Relative Permittivity (ϵ_r):	53.06	55.16	-3.80	5
		e''	21.7800	Conductivity (σ):	1.03	0.99	4.28	5
1/6/2015	Head 835	e'	41.5600	Relative Permittivity (ϵ_r):	41.56	41.50	0.14	5
		e''	19.7200	Conductivity (σ):	0.92	0.90	1.73	5
	Head 820	e'	41.7800	Relative Permittivity (ϵ_r):	41.78	41.60	0.43	5
		e''	19.7700	Conductivity (σ):	0.90	0.90	0.33	5
	Head 850	e'	41.3400	Relative Permittivity (ϵ_r):	41.34	41.50	-0.39	5
		e''	19.6600	Conductivity (σ):	0.93	0.92	1.55	5

8.2. System Check

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

System Performance Check Measurement Conditions:

- The measurements were performed in the flat section of the TWIN SAM or ELI phantom, shell thickness: 2.0 ±0.2 mm (bottom plate) filled with Body or Head simulating liquid of the following parameters.
- The depth of tissue-equivalent liquid in a phantom must be ≥ 15.0 cm for SAR measurements ≤ 3 GHz and ≥ 10.0 cm for measurements > 3 GHz.
- The DASY system with an E-Field Probe was used for the measurements.
- The dipole was mounted on the small tripod so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10 mm (above 1 GHz) and 15 mm (below 1 GHz) from dipole center to the simulating liquid surface.
- The coarse grid with a grid spacing of 15 mm was aligned with the dipole.
  For 5 GHz band - The coarse grid with a grid spacing of 10 mm was aligned with the dipole.
- Special 7x7x7 (below 3 GHz) and/or 8x8x7 (above 3 GHz) fine cube was chosen for the cube.
- Distance between probe sensors and phantom surface was set to 3 mm.
  For 5 GHz band - Distance between probe sensors and phantom surface was set to 2.5 mm
- The dipole input power (forward power) was 100 mW.
- The results are normalized to 1 W input power.

Reference Target SAR Values

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

System Dipole	Serial No.	Cal. Date	Freq. (MHz)	Target SAR Values (W/kg)		
				1g/10g	Head	Body
D835V2	4d117	5/16/2014	835	1g	9.23	9.61
				10g	5.98	6.31
D1900V2	5d043	11/7/2014	1900	1g	40.6	40.0
				10g	21.1	21.3
D2450V2	899	9/10/2014	2450	1g	52.3	50.5
				10g	24.3	23.5

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 B

Date Tested	System Dipole		T.S. Liquid		Measured Results		Target (Ref. Value)	Delta ±10 %	Plot No.
	Type	Serial #			Zoom Scan to 100 mW	Normalize to 1 W			
1/5/2015	D2450V2	899	Head	1g	5.51	55.1	52.3	5.35	
				10g	2.52	25.2	24.3	3.70	
1/5/2015	D2450V2	899	Body	1g	5.36	53.6	50.5	6.14	1,2
				10g	2.45	24.5	23.5	4.26	

SAR Lab E

Date Tested	System Dipole		T.S. Liquid		Measured Results		Target (Ref. Value)	Delta ±10 %	Plot No.
	Type	Serial #			Zoom Scan to 100 mW	Normalize to 1 W			
1/6/2015	D1900V2	5d043	Head	1g	4.21	42.1	40.6	3.69	3,4
				10g	2.15	21.5	21.1	1.90	
1/6/2015	D1900V2	5d043	Body	1g	3.99	39.9	40.0	-0.25	
				10g	2.06	20.6	21.3	-3.29	

SAR Lab G

Date Tested	System Dipole		T.S. Liquid		Measured Results		Target (Ref. Value)	Delta ±10 %	Plot No.
	Type	Serial #			Zoom Scan to 100 mW	Normalize to 1 W			
1/6/2015	D835V2	4d117	Head	1g	0.973	9.73	9.23	5.42	
				10g	0.635	6.35	5.98	6.19	
1/6/2015	D835V2	4d117	Body	1g	1.02	10.2	9.61	6.14	5,6
				10g	0.673	6.73	6.31	6.66	

9. Conducted Output Power Measurements

9.1. GSM

GSM850 Measured Results

Band	Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Burst Pwr (dBm)	Frame Pwr (dBm)
850	GSM (Voice)	CS1	1	128	824.2	32.2	23.2
				190	836.6	32.2	23.2
				251	848.8	32.2	23.2
	GPRS (GMSK)	CS1	1	128	824.2	32.2	23.2
				190	836.6	32.2	23.2
				251	848.8	32.2	23.2
			2	128	824.2	30.3	24.3
				190	836.6	30.4	24.4
				251	848.8	30.5	24.5
			3	128	824.2	28.2	23.9
				190	836.6	28.4	24.1
				251	848.8	28.5	24.2
			4	128	824.2	26.2	23.2
				190	836.6	26.3	23.3
				251	848.8	26.5	23.5

Notes:

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

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

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	29.0	20.0
				661	1880.0	29.1	20.1
				810	1909.8	29.1	20.1
	GPRS (GMSK)	CS1	1	512	1850.2	29.0	20.0
				661	1880.0	29.1	20.1
				810	1909.8	29.1	20.1
			2	512	1850.2	27.5	21.5
				661	1880.0	27.5	21.5
				810	1909.8	27.5	21.5
			3	512	1850.2	25.5	21.2
				661	1880.0	25.5	21.2
				810	1909.8	25.5	21.2
			4	512	1850.2	23.5	20.5
				661	1880.0	23.5	20.5
				810	1909.8	23.5	20.5

Notes:

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

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

9.2. W-CDMA

Release 99 Setup Procedures used to establish the test signals

The following tests were completed according to the test requirements outlined in section 5.2 of the 3GPP TS34.121-1 specification. The DUT supports power Class 3, which has a nominal maximum output power of 24 dBm (+1.7/-3.7).

Mode	Subtest	Rel99
WCDMA General Settings	Loopback Mode	Test Mode 2
	Rel99 RMC	12.2kbps RMC
	Power Control Algorithm	Algorithm2
	βc/βd	8/15

HSDPA Setup Procedures used to establish the test signals

The following 4 Sub-tests were completed according to Release 7 procedures in section 5.2 of 3GPP TS34.121. A summary of these settings are illustrated below:

	Mode	HSDPA	HSDPA	HSDPA	HSDPA
	Subtest	1	2	3	4
W-CDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set 1			
	Power Control Algorithm	Algorithm 2			
	βc	2/15	11/15	15/15	15/15
	βd	15/15	15/15	8/15	4/15
	Bd (SF)	64			
	βc/βd	2/15	12/15	15/8	15/4
	βhs	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			
	Ahs=βhs/βc	30/15			

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

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

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

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

The following 5 Sub-tests were completed according to Release 6 procedures in section 5.2 of 3GPP TS34.121. A summary of these settings are illustrated below:

	Mode	HSPA				
	Subtest	1	2	3	4	5
WCDMA General Settings	Loopback Mode	Test Mode 1				
	Rel99 RMC	12.2 kbps RMC				
	HSDPA FRC	H-Set 1				
	HSUPA Test	HSPA				
	Power Control Algorithm	Algorithm 2				Algorithm 1
	βc	11/15	6/15	15/15	2/15	15/15
	βd	15/15	15/15	9/15	15/15	0
	βec	209/225	12/15	30/15	2/15	5/15
	βc/βd	11/15	6/15	15/9	2/15	15/1
	βhs	22/15	12/15	30/15	4/15	5/15
	βed	1309/225	94/75	47/15	56/75	47/15
	CM (dB)	1	3	2	3	1
	MPR (dB)	0	2	1	2	0
HSDPA Specific Settings	DACK	8				0
	DNAK	8				0
	DCQI	8				0
	Ack-Nack repetition factor	3				
	CQI Feedback (Table 5.2B.4)	4ms				
	CQI Repetition Factor (Table 5.2B.4)	2				
	Ahs = βhs/βc	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

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

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

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

Measured Results

Band	Mode		UL Ch No.	Freq. (MHz)	Avg Pwr (dBm)
W-CDMA Band V	Rel 99	RMC, 12.2 kbps	4132	826.4	22.4
			4183	836.6	22.3
			4233	846.6	22.3
	HSDPA	Subtest 1	4132	826.4	21.5
			4183	836.6	21.3
			4233	846.6	20.6
		Subtest 2	4132	826.4	21.3
			4183	836.6	21.1
			4233	846.6	21.3
		Subtest 3	4132	826.4	21.0
			4183	836.6	20.8
			4233	846.6	21.0
		Subtest 4	4132	826.4	21.0
			4183	836.6	20.9
			4233	846.6	21.1
	HSUPA	Subtest 1	4132	826.4	20.0
			4183	836.6	20.0
			4233	846.6	21.2
		Subtest 2	4132	826.4	21.1
			4183	836.6	21.0
			4233	846.6	21.3
		Subtest 3	4132	826.4	21.0
			4183	836.6	20.8
			4233	846.6	21.1
		Subtest 4	4132	826.4	21.2
			4183	836.6	21.0
			4233	846.6	21.2
		Subtest 5	4132	826.4	21.4
			4183	836.6	21.2
			4233	846.6	21.2

9.3. Wi-Fi DTS (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	13.8	Yes
			6	2437	13.8	
			11	2462	13.7	
	802.11g	6 Mbps	1	2412	11.2	No
			6	2437	11.3	
			11	2462	11.2	
	802.11n (HT20)	MCS0	1	2412	12.1	No
			6	2437	12.1	
			11	2462	12.1	

Note(s):

1. 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	13.8	Yes
			2 Mbps	13.7	No
			5.5 Mbps	13.7	No
			11 Mbps	13.7	No

Note(s):

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

9.4. Bluetooth

Maximum tune-up tolerance limit is 9.5 dBm from the rated nominal maximum output power. This power level qualifies for exclusion of SAR testing.

10. Measured and Reported (Scaled) SAR Results

SAR Test Reduction criteria are as follows:

KDB 447498 D01 General RF Exposure Guidance:

Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:

- ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
- ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
- ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz

KDB 941225 D01 SAR test for 3G devices:

When the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤ ¼ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode

10.1. GSM850

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Voice	0	Left Touch	190	836.6	32.8	32.2	0.500	0.574	1
			Left Tilt	190	836.6	32.8	32.2	0.289	0.332	
			Right Touch	190	836.6	32.8	32.2	0.441	0.506	
			Right Tilt	190	836.6	32.8	32.2	0.258	0.296	
Head VoIP	GPRS 2 Slots	0	Left Touch	190	836.6	30.9	30.4	0.667	0.748	2
			Left Tilt	190	836.6	30.9	30.4	0.389	0.436	
			Right Touch	190	836.6	30.9	30.4	0.591	0.663	
			Right Tilt	190	836.6	30.9	30.4	0.348	0.390	
Body-worn	Voice	10	Rear	190	836.6	32.8	32.2	0.527	0.605	3
			Front	190	836.6	32.8	32.2	0.436	0.501	
Body-worn(VoIP) & Hotspot	GPRS 2 Slots	10	Rear	190	836.6	30.9	30.4	0.695	0.780	4
			Front	190	836.6	30.9	30.4	0.568	0.637	
Hotspot			Edge 2	190	836.6	30.9	30.4	0.268	0.301	
			Edge 3	190	836.6	30.9	30.4	0.084	0.094	
			Edge 4	190	836.6	30.9	30.4	0.335	0.376	

10.2. GSM1900

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Voice	0	Left Touch	661	1880.0	29.8	29.1	0.330	0.388	
			Left Tilt	661	1880.0	29.8	29.1	0.220	0.258	
			Right Touch	661	1880.0	29.8	29.1	0.509	0.598	5
			Right Tilt	661	1880.0	29.8	29.1	0.176	0.207	
Head VoIP	GPRS 2 Slots	0	Left Touch	661	1880.0	27.8	27.5	0.445	0.477	
			Left Tilt	661	1880.0	27.8	27.5	0.308	0.330	
			Right Touch	512	1850.2	27.8	27.5	0.802	0.859	
				661	1880.0	27.8	27.5	0.837	0.897	
				810	1909.8	27.8	27.5	0.893	0.957	6
			Right Tilt	661	1880.0	27.8	27.5	0.305	0.327	
Body-worn	Voice	10	Rear	661	1880.0	29.8	29.1	0.433	0.509	7
			Front	661	1880.0	29.8	29.1	0.393	0.462	
Body-worn(VoIP) & Hotspot	GPRS 2 Slots	10	Rear	661	1880.0	27.8	27.5	0.583	0.625	8
			Front	661	1880.0	27.8	27.5	0.532	0.570	
Hotspot			Edge 2	661	1880.0	27.8	27.5	0.229	0.245	
			Edge 3	661	1880.0	27.8	27.5	0.162	0.174	
			Edge 4	661	1880.0	27.8	27.5	0.051	0.055	

10.3. W-CDMA Band V

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Rel 99 RMC	0	Left Touch	4183	836.6	23.0	22.3	0.367	0.431	9
			Left Tilt	4183	836.6	23.0	22.3	0.176	0.207	
			Right Touch	4183	836.6	23.0	22.3	0.338	0.397	
			Right Tilt	4183	836.6	23.0	22.3	0.176	0.207	
Body-worn & Hptspot	Rel 99 RMC	10	Rear	4183	836.6	23.0	22.3	0.449	0.528	10
			Front	4183	836.6	23.0	22.3	0.365	0.429	
Hotspot	Rel 99 RMC	10	Edge 2	4183	836.6	23.0	22.3	0.153	0.180	
			Edge 3	4183	836.6	23.0	22.3	0.052	0.061	
			Edge 4	4183	836.6	23.0	22.3	0.200	0.235	

10.4. 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	14.0	13.8	0.209	0.219	11
				Left Tilt	6	2437.0	14.0	13.8	0.094	0.099	
				Right Touch	6	2437.0	14.0	13.8	0.098	0.102	
				Right Tilt	6	2437.0	14.0	13.8	0.052	0.054	
	Body-worn & Hotspot	802.11b 1 Mbps	10	Rear	6	2437.0	14.0	13.8	0.050	0.053	12
				Front	6	2437.0	14.0	13.8	0.044	0.046	
	Hotspot	802.11b 1 Mbps	10	Edge 1	6	2437.0	14.0	13.8	0.019	0.020	
				Edge 2	6	2437.0	14.0	13.8	0.051	0.054	13

10.5. Bluetooth

Standalone SAR Test Exclusion Considerations & Estimated SAR

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)]·[√f(GHz)] ≤ 3.0, for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

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

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

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

- *(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)]·[√$f_{(GHz)}$/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.

Body-worn Accessory Exposure Conditions

Max. tune-up tolerance limit		Min. test separation distance (mm)	Frequency (GHz)	SAR test exclusion Result*	Test Configuration	Estimated 1-g SAR (W/kg)
(dBm)	(mW)					
9.5	9	10	2.480	1.4	Rear/Front	0.187

Conclusion:

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

11. SAR Measurement Variability

In accordance with published RF Exposure KDB 865664 D01 SAR measurement 100 MHz to 6 GHz. These additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

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

Frequency Band (MHz)	Air Interface	RF Exposure Conditions	Test Position	Repeated SAR (Yes/No)	Highest Measured SAR (W/kg)	Repeated Measured SAR (W/kg)	Largest to Smallest SAR Ratio
850	GSM 850	Body (VoIP) & Hotspot	Rear	No	0.695	N/A	N/A
	WCDMA Band V	Body & Hotspot	Rear	No	0.449	N/A	N/A
1900	GSM 1900	Head (VoIP)	Right Touch	Yes	0.893	0.889	1.00
2400	Wi-Fi 802.11b/g/n	Head	Left Touch	No	0.209	N/A	N/A

Note(s):

Second Repeated Measurement is not required since the ratio of the largest to smallest SAR for the original and first repeated measurement is not > 1.20.

12. Simultaneous Transmission SAR Analysis

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

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

Where:

SAR_1 is the highest measured or estimated SAR for the first of a pair of simultaneous transmitting antennas, in a specific test operating mode and exposure condition

SAR_2 is the highest measured or estimated SAR for the second of a pair of simultaneous transmitting antennas, in the same test operating mode and exposure condition as the first

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

In order for a pair of simultaneous transmitting antennas with the sum of 1-g SAR > 1.6 W/kg to qualify for exemption from Simultaneous Transmission SAR measurements, it has to satisfy the condition of:

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

Simultaneous Transmission Condition

RF Exposure Condition	Item	Capable Transmit Configurations		
Head	1	GSM(Voice)	+	Wi-Fi 2.4 GHz
	2	GSM(GPRS)	+	Wi-Fi 2.4 GHz
	3	W-CDMA	+	Wi-Fi 2.4 GHz
Body-worn	1	GSM(Voice)	+	Wi-Fi 2.4 GHz
	2	GSM(Voice)	+	BT
	3	GSM(GPRS)	+	Wi-Fi 2.4 GHz
	4	GSM(GPRS)	+	BT
	5	W-CDMA	+	Wi-Fi 2.4 GHz
	6	W-CDMA	+	BT
Hotspot & Wi-Fi Direct	1	GSM(GPRS)	+	Wi-Fi 2.4 GHz
	2	W-CDMA	+	Wi-Fi 2.4 GHz
Notes:				
1. Wi-Fi only 2.4GHz supports Hotspot.				
2. GPRS and W-CDMA support Hotspot.				
3. VoIP is supported in GPRS and W-CDMA.				
4. Wi-Fi 2.4 GHz Radio cannot transmit simultaneously with Bluetooth Radio.				

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

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario			∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① GSM850	② Wi-Fi(DTS)	③ Bluetooth		
Head	Left Touch	① + ②	0.748	0.219		0.967	No
	Left Tilt	① + ②	0.436	0.099		0.535	No
	Right Touch	① + ②	0.663	0.102		0.765	No
	Right Tilt	① + ②	0.390	0.054		0.444	No
Body-worn Accessory & Hotspot	Rear	① + ②	0.780	0.053		0.833	No
		① + ③	0.780		0.187	0.967	No
	Front	① + ②	0.637	0.046		0.683	No
		① + ③	0.637		0.187	0.824	No
Hotspot	Edge 2	① + ②	0.301	0.054		0.355	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.

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

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario			∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① GSM1900	② Wi-Fi(DTS)	③ Bluetooth		
Head	Left Touch	① + ②	0.477	0.219		0.696	No
	Left Tilt	① + ②	0.330	0.099		0.429	No
	Right Touch	① + ②	0.957	0.102		1.059	No
	Right Tilt	① + ②	0.327	0.054		0.381	No
Body-worn Accessory & Hotspot	Rear	① + ②	0.625	0.053		0.678	No
		① + ③	0.625		0.187	0.812	No
	Front	① + ②	0.570	0.046		0.616	No
		① + ③	0.570		0.187	0.757	No
Hotspot	Edge 2	① + ②	0.245	0.054		0.299	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.

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

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario			∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① W-CDMA Band V	② Wi-Fi(DTS)	③ Bluetooth		
Head	Left Touch	① + ②	0.431	0.219		0.650	No
	Left Tilt	① + ②	0.207	0.099		0.306	No
	Right Touch	① + ②	0.397	0.102		0.499	No
	Right Tilt	① + ②	0.207	0.054		0.261	No
Body-worn Accessory & Hotspot	Rear	① + ②	0.528	0.053		0.581	No
		① + ③	0.528		0.187	0.715	No
	Front	① + ②	0.429	0.046		0.475	No
		① + ③	0.429		0.187	0.616	No
Hotspot	Edge 2	① + ②	0.180	0.054		0.234	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.

Conclusion:

Simultaneous transmission SAR measurement (Volume Scan) is not required because the either sum of the 1-g SAR is < 1.6 W/kg or the SPLSR is < 0.04 for all circumstances that require SPLSR calculation.

Appendixes

Refer to separated files for the following appendixes.

A_15I19740v0 SAR Photos & Ant. Locations

B_15I19740v0 SAR Highest Test Plots

C_15I19740v0 SAR System Check Plots

D_15I19740v0 SAR Tissue Ingredients

E_15I19740v0 SAR Probe Cal. Certificates

F_15I19740v0 SAR Dipole Cal. Certificates

END OF REPORT