



SAR EVALUATION REPORT

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

The model FCC ID: A3LSMG316M shares the same enclosure and circuit board as model FCC ID: A3LSMG316HU. The WLAN/Bluetooth circuitry and layout, including antenna, are almost identical between the two units. The WLAN/Bluetooth antenna and surrounding circuitry is the same between these two units, and tune up power targets are identical for WLAN and Bluetooth operations. For this reason the SAR data for the WLAN and Bluetooth operations for FCC ID: A3LSMG316HU is considered representative for FCC ID: A3LSMG316M.

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

**FCC ID: A3LSMG316M
Model Name: SM-G316M/DS and SM-G316M**

**Report Number: 14I19534-S1A
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Prepared for
**Samsung Electronics Co., Ltd.
129 Samsung-ro, Yeongtong-Gu
Suwon-City, GyeonGggi-Do, South Korea, 443-742**

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.	Date	Revisions	Revised By
--	1/8/2015	Initial Issue	--
A	1/9/2015	Revised Report based on Reviewer's comment: 1. Sec. 4.3: added note.	Chakrit Thammanavarat

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1. Attestation of Test Results

Applicant Name		Samsung Electronics Co., Ltd.			
FCC ID		A3LSMG316M			
Model Name		SM-G316M/DS and SM-G316M			
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		0.534	0.444		
Body-worn*		1.080	0.140		
Hotspot/Wi-Fi Direct		1.080	0.140		
Simultaneous TX	Head	0.978	0.978	N/A	N/A
	Body-worn*	1.220	1.220		
	Hotspot/ Wi-Fi Direct	1.220	1.220		
<p>*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.</p>					
Date Tested		10/3/2014 to 10/6/2014; 12/8/2014 to 12/23/2014			
Test Results		Pass			
<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:			Prepared By:		
					
Bobby Bayani Senior Engineer UL Verification Services Inc.			Yu Chen 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 D03 Supplement C Cross-Reference
- 447498 D01 General RF Exposure Guidance v05r02
- 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

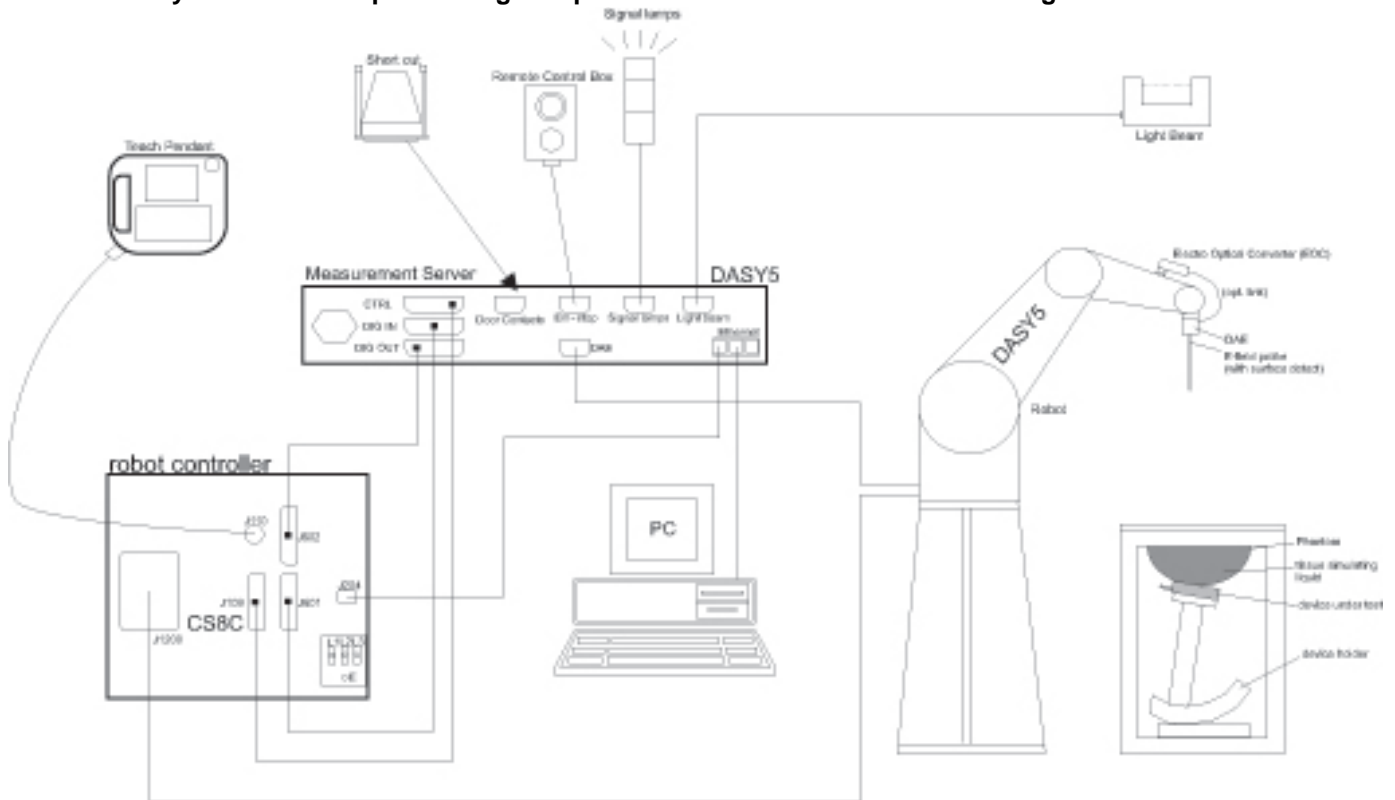
47173 Benicia Street	47266 Benicia Street
SAR Lab A	SAR Lab 1
SAR Lab B	SAR Lab 2
SAR Lab C	SAR Lab 3
SAR Lab D	SAR Lab 4
SAR Lab E	SAR Lab 5
SAR Lab F	
SAR Lab G	
SAR Lab H	

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	$\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5$ mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ± 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: $\Delta x_{Zoom}, \Delta y_{Zoom}$		≤ 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 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
Network Analyzer	Agilent	E753ES	MY40000980	4/7/2015
Dielectronic Probe kit	SPEAG	DAK-3.5	1087	11/13/2014*
Dielectronic Probe kit	SPEAG	DAK-3.5 Short	SM DAK 200 BA	N/A
Thermometer	Cole-Parmer Instrument Co.	91100-50	1007	7/31/2015
Thermometer	EXTECH	445703	CCS-200	3/24/2015

Notes:

*. Dielectronic Probe Kit was used for testing of model FCC ID: A3LSMG316H only.

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
HP Signal Generator	HP	8665B	3546A00784	6/23/2015
Power Meter	HP	437B	3125U16345	6/16/2015
Power Sensor	Agilent	8481A	2702A60780	6/16/2015
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1622052	N/A
Bi-directional coupler	Werlatone, Inc.	C8060-102	2711	N/A
DC Power Supply	Sorensen Ametek	XT20-3	1318A00530	N/A
Synthesized Signal Generator	Agilent	8665B	3438A00633	7/10/2015
Power Meter	Agilent	N1911A	MY53060016	8/7/2015
Power Sensor	Agilent	E9323A	MY53070003	5/1/2015
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1808938	N/A
Bi-directional coupler	Werlatone, Inc.	C8060-102	2710	N/A
DC Power Supply	HP	6296A	2841A-05955	N/A

System Check (Continued)

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
E-Field Probe	SPEAG	EX3DV4	3772	2/26/2015
E-Field Probe	SPEAG	EX3DV4	3686	3/18/2015
E-Field Probe	SPEAG	EX3DV4	3902	5/19/2015
Data Acquisition Electronics	SPEAG	DAE4	1259	1/23/2015
Data Acquisition Electronics	SPEAG	DAE3	500	5/15/2015
Data Acquisition Electronics	SPEAG	DAE4	1258	5/15/2015
Data Acquisition Electronics	SPEAG	DAE3	427	1/21/2015
System Validation Dipole	SPEAG	D835V2	4d117	5/16/2015
System Validation Dipole	SPEAG	D1900V2	5d140	4/23/2015
System Validation Dipole	SPEAG	D2450V2	706	5/20/2015

Others

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Power Meter	Agilent	N1912A	MY50001018	9/13/2015
Power Sensor	Agilent	N1921A	MY52200012	9/26/2015
Base Station Simulator	R & S	CMW500	134855-bw	7/15/2015

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): 121.4 mm x 62.9 mm Overall Diagonal: 136.7 mm Display Diagonal: 115.7 mm
Battery Back Cover	<input checked="" type="checkbox"/> Normal Battery Cover
Battery Options	<input checked="" type="checkbox"/> Standard – Lithium-ion battery, Rating 3.8Vdc, 5.70Wh
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)

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: <input type="checkbox"/> Class 8 - One Up <input type="checkbox"/> Class 10 - Two Up <input checked="" type="checkbox"/> Class 12 - Four Up <input type="checkbox"/> Class 33 - Four Up DTM (Dual Transfer Mode): Not supported		
W-CDMA (UMTS)	Band II Band V	UMTS Rel. 99 (Voice & Data) HSDPA (Rel. 7) HSUPA (Rel. 6) HSPA+ (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	32.5	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	27.0	27.5
GSM1900	Voice	29.2	29.7
	GPRS 1 slot	29.2	29.7
	GPRS 2 slots	27.2	27.7
	GPRS 3 slots	25.2	25.7
	GPRS 4 slots	24.0	24.5
W-CDMA Band V	R99	22.5	23.0
	HSDPA	22.5	23.0
	HSUPA	22.5	23.0
W-CDMA Band II	R99	21.8	22.3
	HSDPA	21.8	22.3
	HSUPA	21.8	22.3

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	14.0	14.5
	802.11n HT20	12.0	12.5
Bluetooth		8.5	9.0
Bluetooth LE		8.0	8.5

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	No	1
			Edge 3 (Bottom)	> 25 mm	No	1
			Edge 4 (Left)	< 25 mm	Yes	

Notes:

- SAR is not required because the distance from the antenna to the edge is > 25 mm as per KDB 941225 D06 Hot Spot SAR.
- 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 $\pm 2^\circ\text{C}$ 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.

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 A

	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
12/10/2014	Head 835	e'	40.2100	Relative Permittivity (ϵ_r):	40.21	41.50	-3.11	5
		e"	19.5900	Conductivity (σ):	0.91	0.90	1.06	5
	Head 820	e'	40.3000	Relative Permittivity (ϵ_r):	40.30	41.60	-3.13	5
		e"	19.5200	Conductivity (σ):	0.89	0.90	-0.94	5
	Head 850	e'	40.0400	Relative Permittivity (ϵ_r):	40.04	41.50	-3.52	5
		e"	19.5100	Conductivity (σ):	0.92	0.92	0.78	5
12/10/2014	Body 835	e'	54.7400	Relative Permittivity (ϵ_r):	54.74	55.20	-0.83	5
		e"	21.6900	Conductivity (σ):	1.01	0.97	3.82	5
	Body 820	e'	54.4700	Relative Permittivity (ϵ_r):	54.47	55.28	-1.46	5
		e"	21.8500	Conductivity (σ):	1.00	0.97	2.87	5
	Body 850	e'	55.1200	Relative Permittivity (ϵ_r):	55.12	55.16	-0.07	5
		e"	21.3600	Conductivity (σ):	1.01	0.99	2.27	5

SAR Lab H

	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
12/11/2014	Head 1900	e'	40.2400	Relative Permittivity (ϵ_r):	40.24	40.00	0.60	5
		e"	13.5000	Conductivity (σ):	1.43	1.40	1.87	5
	Head 1850	e'	39.8100	Relative Permittivity (ϵ_r):	39.81	40.00	-0.47	5
		e"	13.4500	Conductivity (σ):	1.38	1.40	-1.18	5
	Head 1910	e'	40.4000	Relative Permittivity (ϵ_r):	40.40	40.00	1.00	5
		e"	13.3100	Conductivity (σ):	1.41	1.40	0.97	5
12/11/2014	Body 1900	e'	51.4800	Relative Permittivity (ϵ_r):	51.48	53.30	-3.41	5
		e"	14.8100	Conductivity (σ):	1.56	1.52	2.94	5
	Body 1850	e'	50.8100	Relative Permittivity (ϵ_r):	50.81	53.30	-4.67	5
		e"	14.9600	Conductivity (σ):	1.54	1.52	1.24	5
	Body 1910	e'	51.6200	Relative Permittivity (ϵ_r):	51.62	53.30	-3.15	5
		e"	14.6100	Conductivity (σ):	1.55	1.52	2.08	5
12/22/2014	Head 1900	e'	39.5000	Relative Permittivity (ϵ_r):	39.50	40.00	-1.25	5
		e"	13.6800	Conductivity (σ):	1.45	1.40	3.23	5
	Head 1850	e'	39.6800	Relative Permittivity (ϵ_r):	39.68	40.00	-0.80	5
		e"	13.6100	Conductivity (σ):	1.40	1.40	0.00	5
	Head 1910	e'	39.4800	Relative Permittivity (ϵ_r):	39.48	40.00	-1.30	5
		e"	13.6900	Conductivity (σ):	1.45	1.40	3.85	5
12/22/2014	Body 1900	e'	51.3600	Relative Permittivity (ϵ_r):	51.36	53.30	-3.64	5
		e"	14.7300	Conductivity (σ):	1.56	1.52	2.38	5
	Body 1850	e'	51.5200	Relative Permittivity (ϵ_r):	51.52	53.30	-3.34	5
		e"	14.6200	Conductivity (σ):	1.50	1.52	-1.06	5
	Body 1910	e'	51.3500	Relative Permittivity (ϵ_r):	51.35	53.30	-3.66	5
		e"	14.7500	Conductivity (σ):	1.57	1.52	3.06	5

SAR Lab 1

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

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.
- 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	5d140	4/23/2014	1900	1g	40.1	40.2
				10g	21.0	21.3
D2450V2	706	5/20/2014	2450	1g	53.0	50.2
				10g	24.5	23.4

System Check Results

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

SAR Lab A

Date Tested	System Dipole		T.S. Liquid	Measured Results		Target (Ref. Value)	Delta $\pm 10\%$	Plot No.	
	Type	Serial #		Zoom Scan to 100 mW	Normalize to 1 W				
12/10/2014	D835V2	4d117	Head	1g	0.969	9.69	9.23	4.98	
				10g	0.635	6.35	5.98	6.19	
12/10/2014	D835V2	4d117	Body	1g	1.01	10.1	9.61	5.10	1,2
				10g	0.667	6.67	6.31	5.71	

SAR Lab H

Date Tested	System Dipole		T.S. Liquid	Measured Results		Target (Ref. Value)	Delta $\pm 10\%$	Plot No.	
	Type	Serial #		Zoom Scan to 100 mW	Normalize to 1 W				
12/11/2014	D1900V2	5d140	Head	1g	4.24	42.4	40.1	5.74	3,4
				10g	2.19	21.9	21.0	4.29	
12/11/2014	D1900V2	5d140	Body	1g	3.80	38.0	40.2	-5.47	
				10g	1.97	19.7	21.3	-7.51	
12/22/2014	D1900V2	5d140	Head	1g	4.02	40.2	40.1	0.25	
				10g	2.07	20.7	21.0	-1.43	
12/22/2014	D1900V2	5d140	Body	1g	4.13	41.3	40.2	2.74	
				10g	2.14	21.4	21.3	0.47	

SAR Lab 1

Date Tested	System Dipole		T.S. Liquid	Measured Results		Target (Ref. Value)	Delta $\pm 10\%$	Plot No.	
	Type	Serial #		Zoom Scan to 100 mW	Normalize to 1 W				
10/6/2014	D2450V2	706	Head	1g	4.95	49.5	53.0	-6.60	
				10g	2.25	22.5	24.5	-8.16	
10/6/2014	D2450V2	706	Body	1g	5.37	53.7	50.2	6.97	5,6
				10g	2.49	24.9	23.4	6.41	

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	32.1	23.1
				190	836.6	32.2	23.2
				251	848.8	32.3	23.3
	GPRS (GMSK)	CS1	1	128	824.2	32.1	23.1
				190	836.6	32.2	23.2
				251	848.8	32.3	23.3
			2	128	824.2	30.4	24.4
				190	836.6	30.5	24.5
				251	848.8	30.5	24.5
			3	128	824.2	28.5	24.2
				190	836.6	28.6	24.3
				251	848.8	28.7	24.4
			4	128	824.2	26.5	23.5
				190	836.6	26.6	23.6
				251	848.8	26.7	23.7

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	29.1	20.1
				661	1880.0	29.1	20.1
				810	1909.8	29.4	20.3
	GPRS (GMSK)	CS1	1	512	1850.2	29.1	20.1
				661	1880.0	29.1	20.1
				810	1909.8	29.3	20.3
			2	512	1850.2	27.2	21.2
				661	1880.0	27.2	21.2
				810	1909.8	27.1	21.1
			3	512	1850.2	25.7	21.4
				661	1880.0	25.7	21.4
				810	1909.8	25.6	21.3
			4	512	1850.2	23.6	20.6
				661	1880.0	23.6	20.6
				810	1909.8	23.6	20.6

Notes:

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

- Head & Body-worn Accessory: GMSK Voice Mode
- Hotspot mode: GMSK (GPRS) mode with 3 time slots, based on the output power measurements above

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
	β_c/β_d	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			
	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			

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
	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	6/15	15/9	2/15	15/1
	β_{hs}	22/15	12/15	30/15	4/15	5/15
	β_{ed}	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				
	$A_{hs} = \beta_{hs}/\beta_c$	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	

HSPA+

Since 16QAM is not used for uplink, the uplink Category and release is same as HSUPA, i.e., CAT 6 Rel 6. Therefore, the RF conducted power is not measured.

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	22.5		
			4183	836.6	22.4		
			4233	846.6	22.3		
	HSDPA	Subtest 1		4132	826.4	22.0	
				4183	836.6	22.3	
				4233	846.6	22.1	
		Subtest 2		4132	826.4	22.1	
				4183	836.6	22.3	
				4233	846.6	22.1	
		Subtest 3		4132	826.4	22.2	
				4183	836.6	22.4	
				4233	846.6	22.1	
		Subtest 4		4132	826.4	22.2	
				4183	836.6	22.4	
				4233	846.6	22.2	
		HSUPA	Subtest 1		4132	826.4	21.0
					4183	836.6	22.0
					4233	846.6	21.1
	Subtest 2			4132	826.4	21.0	
				4183	836.6	21.0	
				4233	846.6	21.0	
	Subtest 3			4132	826.4	21.0	
				4183	836.6	21.2	
				4233	846.6	21.1	
	Subtest 4			4132	826.4	21.0	
				4183	836.6	21.0	
				4233	846.6	21.1	
	Subtest 5			4132	826.4	22.4	
				4183	836.6	22.5	
				4233	846.6	22.4	

Band	Mode		UL Ch No.	Freq. (MHz)	Avg Pwr (dBm)
W-CDMA Band II	Rel 99	RMC, 12.2 kbps	9262	1852.4	21.5
			9400	1880.0	21.5
			9538	1907.6	21.4
	HSDPA	Subtest 1	9262	1852.4	20.9
			9400	1880.0	20.8
			9538	1907.6	21.3
		Subtest 2	9262	1852.4	20.8
			9400	1880.0	20.7
			9538	1907.6	21.3
		Subtest 3	9262	1852.4	20.8
			9400	1880.0	20.7
			9538	1907.6	21.3
		Subtest 4	9262	1852.4	20.7
			9400	1880.0	20.6
			9538	1907.6	21.2
	HSUPA	Subtest 1	9262	1852.4	20.8
			9400	1880.0	20.7
			9538	1907.6	20.7
		Subtest 2	9262	1852.4	20.3
			9400	1880.0	20.4
			9538	1907.6	20.4
		Subtest 3	9262	1852.4	20.8
			9400	1880.0	20.9
			9538	1907.6	20.6
		Subtest 4	9262	1852.4	20.3
			9400	1880.0	20.3
			9538	1907.6	20.4
		Subtest 5	9262	1852.4	21.6
			9400	1880.0	21.6
			9538	1907.6	21.6

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	16.3	Yes
			6	2437	16.3	
			11	2462	16.1	
	802.11g	6 Mbps	1	2412	13.7	No
			6	2437	14.5	
			11	2462	14.5	
	802.11n (HT20)	MCS0	1	2412	12.5	No
			6	2437	12.5	
			11	2462	12.3	

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	16.3	Yes
			2 Mbps	16.2	No
			5.5 Mbps	16.2	No
			11 Mbps	15.9	No

Note(s):

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

9.4. Bluetooth

Maximum tune-up tolerance limit is 9.00 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:

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.

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	33.0	32.2	0.340	0.409	1
			Left Tilt	190	836.6	33.0	32.2	0.222	0.267	
			Right Touch	190	836.6	33.0	32.2	0.364	0.438	
			Right Tilt	190	836.6	33.0	32.2	0.232	0.279	
Head VoIP	GPRS 2 Slots	0	Left Touch	190	836.6	30.5	30.5	0.460	0.460	2
			Left Tilt	190	836.6	30.5	30.5	0.293	0.293	
			Right Touch	190	836.6	30.5	30.5	0.465	0.465	
			Right Tilt	190	836.6	30.5	30.5	0.302	0.302	
Body-worn	Voice	10	Rear	190	836.6	33.0	32.2	0.611	0.735	3
			Front	190	836.6	33.0	32.2	0.436	0.524	
Body-worn(VoIP) & Hotspot	GPRS 2 Slots	10	Rear	190	836.6	30.5	30.5	0.780	0.780	4
Front			190	836.6	30.5	30.5	0.556	0.556		
Hotspot			Edge 2	190	836.6	30.5	30.5	0.338	0.338	
			Edge 3	190	836.6	30.5	30.5	0.096	0.096	
			Edge 4	190	836.6	30.5	30.5	0.296	0.296	

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	29.7	29.1	0.236	0.271	5
			Left Tilt	661	1880.0	29.7	29.1	0.132	0.152	
			Right Touch	661	1880.0	29.7	29.1	0.279	0.320	
			Right Tilt	661	1880.0	29.7	29.1	0.098	0.113	
Head VoIP	GPRS 3 Slots	0	Left Touch	661	1880.0	25.7	25.7	0.311	0.311	6
			Left Tilt	661	1880.0	25.7	25.7	0.180	0.180	
			Right Touch	661	1880.0	25.7	25.7	0.372	0.372	
			Right Tilt	661	1880.0	25.7	25.7	0.135	0.135	
Body-worn	Voice	10	Rear	661	1880.0	29.7	29.1	0.593	0.681	7
			Front	661	1880.0	29.7	29.1	0.473	0.543	
Body-worn(VoIP) & Hotspot	GPRS 3 Slots	10	Rear	661	1880.0	25.7	25.7	0.785	0.785	8
Front			661	1880.0	25.7	25.7	0.682	0.682		
Hotspot			Edge 2	661	1880.0	25.7	25.7	0.146	0.146	
			Edge 3	661	1880.0	25.7	25.7	0.550	0.550	
			Edge 4	661	1880.0	25.7	25.7	0.134	0.134	

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	22.4	0.321	0.369	9
			Left Tilt	4183	836.6	23.0	22.4	0.207	0.238	
			Right Touch	4183	836.6	23.0	22.4	0.327	0.375	
			Right Tilt	4183	836.6	23.0	22.4	0.201	0.231	
Body-worn & Hptspot	Rel 99 RMC	10	Rear	4183	836.6	23.0	22.4	0.571	0.656	10
			Front	4183	836.6	23.0	22.4	0.375	0.431	
Hotspot	Rel 99 RMC	10	Edge 2	4183	836.6	23.0	22.4	0.261	0.300	
			Edge 3	4183	836.6	23.0	22.4	0.075	0.086	
			Edge 4	4183	836.6	23.0	22.4	0.205	0.235	

10.4. 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	22.3	21.5	0.383	0.460	11
			Left Tilt	9400	1880.0	22.3	21.5	0.189	0.227	
			Right Touch	9400	1880.0	22.3	21.5	0.444	0.534	
			Right Tilt	9400	1880.0	22.3	21.5	0.161	0.194	
Body-worn & Hptspot	Rel 99 RMC	10	Rear	9262	1852.4	22.3	21.5	0.898	1.080	12
				9400	1880.0	22.3	21.5	0.830	0.998	
				9538	1907.6	22.3	21.4	0.842	1.036	
			Front	9262	1852.4	22.3	21.5	0.698	0.839	
				9400	1880.0	22.3	21.5	0.741	0.891	
				9538	1907.6	22.3	21.4	0.758	0.933	
Hotspot	Rel 99 RMC	10	Edge 2	9400	1880.0	22.3	21.5	0.115	0.138	
			Edge 3	9262	1852.4	22.3	21.5	0.690	0.830	
				9400	1880.0	22.3	21.5	0.729	0.876	
				9538	1907.6	22.3	21.4	0.661	0.813	
			Edge 4	9400	1880.0	22.3	21.5	0.140	0.168	

10.5. 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	16.3	0.177	0.185	13
				Left Tilt	6	2437.0	16.5	16.3	0.135	0.141	
				Right Touch	6	2437.0	16.5	16.3	0.424	0.444	
				Right Tilt	6	2437.0	16.5	16.3	0.167	0.175	
	Body-worn & Hotspot	802.11b 1 Mbps	10	Rear	6	2437.0	16.5	16.3	0.134	0.140	14
				Front	6	2437.0	16.5	16.3	0.086	0.090	
	Hotspot	802.11b 1 Mbps	10	Edge 1	6	2437.0	16.5	16.3	0.048	0.050	
				Edge 4	6	2437.0	16.5	16.3	0.118	0.124	

10.6. 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:

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$, 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.

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.

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)					
9.0	8	10	2.480	1.3	Rear/Front	0.167

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	Air Interface	RF Exposure Conditions	Test Position	Repeated SAR	Highest Measured SAR	Repeated Measured SAR	Largest to Smallest
850	GSM 850	Body-worn & Hotspot	Rear	No	0.780	N/A	N/A
	WCDMA Band V	Body-worn & Hotspot	Rear	No	0.571	N/A	N/A
1900	GSM 1900	Body-worn & Hotspot	Rear	No	0.785	N/A	N/A
	WCDMA Band II	Body-worn & Hotspot	Rear	Yes	0.898	0.844	1.06
2400	Wi-Fi 802.11b/g/n	Head	Left Touch	No	0.444	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:

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

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

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

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
	3	GSM(GPRS)	+	Wi-Fi 2.4 GHz
	5	WCDMA	+	Wi-Fi 2.4 GHz
Body-w orn	1	GSM(Voice)	+	Wi-Fi 2.4 GHz
	3	GSM(Voice)	+	BT
	5	GSM(GPRS)	+	Wi-Fi 2.4 GHz
	7	GSM(GPRS)	+	BT
	9	WCDMA	+	Wi-Fi 2.4 GHz
	11	WCDMA	+	BT
Hotspot & Wi-Fi Direct	1	GSM(GPRS)	+	Wi-Fi 2.4 GHz
	3	WCDMA	+	Wi-Fi 2.4 GHz
Notes:				
1. Wi-Fi only 2.4GHz supports Hotspot.				
2. GPRS and WCDMA support Hotspot.				
3. VoIP is supported in GPRS and WCDMA.				
4. Wi-Fi 2.4 GHz Radio cannot transmit simultaneously with Bluetooth Radio.				

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

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	0.460	0.185		0.645	No
	Left Tilt	① + ②	0.293	0.141		0.434	No
	Right Touch	① + ②	0.465	0.444		0.909	No
	Right Tilt	① + ②	0.302	0.175		0.477	No
Body-w orn Accessory & Hotspot	Rear	① + ②	0.780	0.140		0.920	No
		① + ③	0.780		0.167	0.947	No
	Front	① + ②	0.556	0.090		0.646	No
		① + ③	0.556		0.167	0.723	No
Hotspot	Edge 4	① + ②	0.296	0.124		0.420	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

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	0.311	0.185		0.496	No
	Left Tilt	① + ②	0.180	0.141		0.321	No
	Right Touch	① + ②	0.372	0.444		0.816	No
	Right Tilt	① + ②	0.135	0.175		0.310	No
Body-w orn Accessory & Hotspot	Rear	① + ②	0.785	0.140		0.925	No
		① + ③	0.785		0.167	0.952	No
	Front	① + ②	0.682	0.090		0.772	No
		① + ③	0.682		0.167	0.849	No
Hotspot	Edge 4	① + ②	0.134	0.124		0.258	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

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario			Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① W-CDMA Band V	② Wi-Fi(DTS)	③ Bluetooth		
Head	Left Touch	① + ②	0.369	0.185		0.554	No
	Left Tilt	① + ②	0.238	0.141		0.379	No
	Right Touch	① + ②	0.375	0.444		0.819	No
	Right Tilt	① + ②	0.231	0.175		0.406	No
Body-w orn Accessory & Hotspot	Rear	① + ②	0.656	0.140		0.796	No
		① + ③	0.656		0.167	0.823	No
	Front	① + ②	0.431	0.090		0.521	No
		① + ③	0.431		0.167	0.598	No
Hotspot	Edge 4	① + ②	0.235	0.124		0.359	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.

12.4. 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 W-CDMA Band II	② Wi-Fi(DTS)	③ Bluetooth		
Head	Left Touch	① + ②	0.460	0.185		0.645	No
	Left Tilt	① + ②	0.227	0.141		0.368	No
	Right Touch	① + ②	0.534	0.444		0.978	No
	Right Tilt	① + ②	0.194	0.175		0.369	No
Body-w orn Accessory & Hotspot	Rear	① + ②	1.080	0.140		1.220	No
		① + ③	1.080		0.167	1.247	No
	Front	① + ②	0.933	0.090		1.023	No
		① + ③	0.933		0.167	1.100	No
Hotspot	Edge 4	① + ②	0.168	0.124		0.292	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 either the sum of the 1-g SAR is < 1.6 W/kg or the SPLSR is < 0.04 for all circumstances that require SPLSR calculation.

Appendixes

Refer to separated files for the following appendixes.

A_14I17534v0 SAR Photos & Ant. Locations

B_14I17534v0 SAR Highest Test Plots

C_14I17534v0 SAR System Check Plots

D_14I17534v0 SAR Tissue Ingredients

E_14I17534v0 SAR Probe Cal. Certificates

F_14I17534v0 SAR Dipole Cal. Certificates

END OF REPORT