



SAR EVALUATION REPORT

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

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

**Model: SM-A300H
FCC ID: A3LSMA300H**

**Report Number: 14I18839-S1A
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Prepared for
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REVISION HISTORY

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A	10/14/2014	Revised Report based on Reviewer's comment: 1. Cover page, Sec. 1: Removed the NFC and Updated Table. 2. Sec. 6.2: Updated Table. 3. Sec. nos. 6.3, 8.4, 11, and 13: Updated BT Power and Tables. 4. Sec. 9.2; Corrected Liquid Check Table for SAR Lab F.	Krischelle Aurelio

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1. Attestation of Test Results

Applicant Name	SAMSUNG ELECTRONICS CO. LTD.			
Application Purpose	☒ Original Grant ☐ Class II Permissive Change			
FCC ID	SM-A300H/DS			
DUT Description	GSM/WCDMA Phone + Bluetooth, WLAN 2.4GHz b/g/n, ANT+			
Exposure Category	General Population/Uncontrolled Exposure (1g SAR limit: 1.6 W/kg)			
The highest reported SAR	RF Exposure Conditions	Equipment Class		
		Licensed	DTS	UNII
	Head	0.276 W/kg	0.713 W/kg	N/A
	Body-worn Accessory	0.682 W/kg	0.100 W/kg	N/A
	Wireless Router (Hotspot)	1.090 W/kg	0.100 W/kg	N/A
	Simultaneous Transmission	Head: 0.989 W/kg Body: 0.782 W/kg	Head: 0.989 W/kg Body: 0.782 W/kg	Head: N/A Body: N/A
Highest SAR across exposure conditions	1.090 W/kg			
Applicable Standards	FCC 47 CFR § 2.1093 Published RF exposure KDB procedures IEEE Std 1528-2013			
Test Results	Pass			
Date tested	9/16/2014 – 10/07/2014			
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.		Krischelle Aurelio 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 1528-2003 & 2013, the following FCC Published RF exposure KDB procedures, and TCB workshop updates:

- 447498 D01 General RF Exposure Guidance v05r02
- 648474 D04 Handset SAR v01r02
- 941225 D01 SAR test for 3G devices v02
- 941225 D03 SAR Test Reduction GSM GPRS EDGE v01
- 941225 D04 SAR for GSM E GPRS Dual Xfer Mode v01
- 941225 D06 Hotspot Mode SAR v01r01
- 248227 D01 SAR Meas for 802 11abg v01r02
- 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r03
- 865664 D02 SAR Reporting v01r01
- 690783 D01 SAR Listings on Grants v01r03

3. Facilities and Accreditation

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

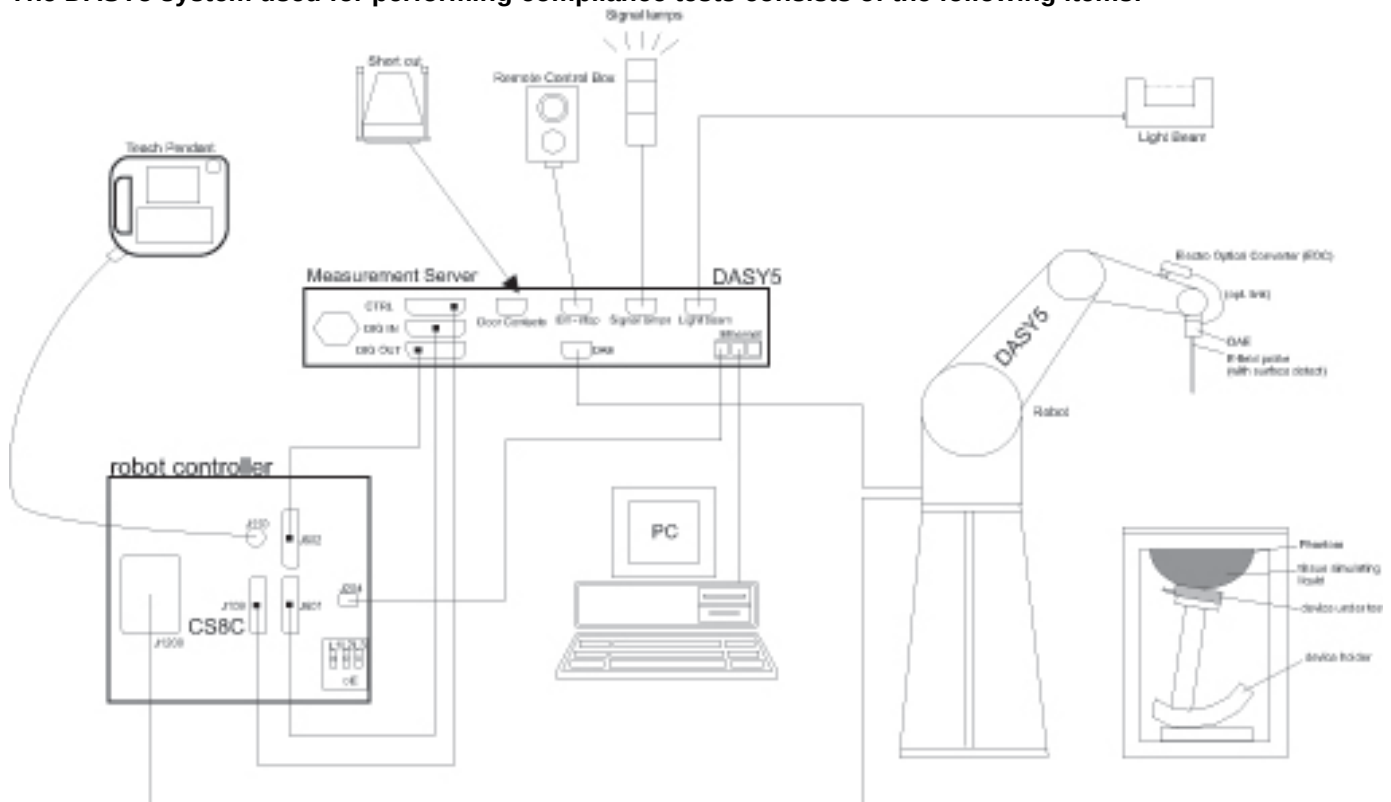
47173 Benicia Street	47266 Benicia Street
SAR Lab A	SAR Lab 1
SAR Lab B	SAR Lab 2
SAR Lab C	SAR Lab 3
SAR Lab D	SAR Lab 4
SAR Lab E	SAR Lab 5
SAR Lab F	
SAR Lab G	
SAR Lab H	

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

4. SAR Measurement System & Test Equipment

4.1. SAR Measurement System

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



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

4.2. SAR Scan Procedure

Step 1: Power Reference Measurement

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

Step 2: Area Scan

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

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

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	$\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5$ mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	$30^\circ \pm 1^\circ$	$20^\circ \pm 1^\circ$
Maximum area scan spatial resolution: $\Delta x_{\text{Area}}, \Delta y_{\text{Area}}$	≤ 2 GHz: ≤ 15 mm $2 - 3$ GHz: ≤ 12 mm	$3 - 4$ GHz: ≤ 12 mm $4 - 6$ GHz: ≤ 10 mm
	When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be $\leq$ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

Step 3: Zoom Scan

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

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

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

Step 4: Power drift measurement

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

Step 5: Z-Scan (FCC only)

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

4.3. Test Equipment

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

Dielectric Property Measurements

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Network Analyzer	Agilent	8753ES	MY40001647	7/17/2015
Dielectronic Probe kit	SPEAG	DAK-3.5	1103	2/18/2015
Dielectronic Probe kit	SPEAG	DAK-3.5 Short	SM DAK 200 BA	N/A
Thermometer	Cole-Palmer	91100-50	1007	7/31/2015

System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Synthesized Signal Generator	HP	8665B	3744A01084	5/20/2015
Power Meter	Agilent	N1912A	MY53040016	5/5/2015
Power Sensor	Agilent	E9323A	MY53070005	5/1/2015
Power Sensor	Agilent	E9323A	MY53070009	5/28/2015
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1795093	N/A
Directional coupler	Werlatone	C8060-102	2149	N/A
DC Power Supply	AMETEK	XT 15-4	1319A02778	N/A
Synthesized Signal Generator	HP	8665B	3744A01155	3/12/2015
Power Meter	HP	437B	3125U11364	8/27/2015
Power Meter	HP	437B	3125U12345	8/15/2015
Power Sensor	HP	8481A	2702A76223	9/17/2015
Power Sensor	HP	8481A	1926A27048	8/15/2015
Amplifier	MITEQ	AMF-4D-0040600-50-30P	1795092	N/A
Directional coupler	Werlatone	C8060-102	2141	N/A
DC Power Supply	BK PRECISION	1611	215-02292	N/A
E-Field Probe	SPEAG	EX3DV4	3936	7/24/2015
E-Field Probe	SPEAG	EX3DV4	3989	4/15/2015
E-Field Probe	SPEAG	EX3DV4	3686	3/18/2015
Data Acquisition Electronics	SPEAG	DAE4	1433	4/14/2015
Data Acquisition Electronics	SPEAG	DAE4	1239	4/14/2015
Data Acquisition Electronics	SPEAG	DAE4	1258	5/15/2015
System Validation Dipole	SPEAG	D2450V2	748	2/18/2015
System Validation Dipole	SPEAG	D835V2	4d002	11/15/2014
System Validation Dipole	SPEAG	D835V2	4d117	5/16/2015
System Validation Dipole	SPEAG	D1900V2	5d140	4/23/2015

Others

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Base Station Simulator	R & S	CMW500	124593-ss	7/31/2015
Base Station Simulator	R & S	CMW500	135387-ng	7/8/2015
Power Meter	Agilent	N1911A	MY53060009	5/5/2015
Power Sensor	Agilent	N1921A	MY52260009	12/12/2014

5. Measurement Uncertainty

Per KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg, the extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2003 & 2013 is not required in SAR reports submitted for equipment approval.

6. Device Under Test (DUT) Information

6.1. DUT Description

Model: SM-A300H/DS	
Device Dimension	Overall (Length x Width): 130 mm x 65 mm Overall Diagonal: 140mm Display Diagonal: 115mm
Battery Back Cover	☒ The rechargeable battery is not user accessible.
Battery Options	☒ The rechargeable battery is not user accessible.
Accessory	Headset
Wireless Router (Hotspot)	Wi-Fi Hotspot mode permits the device to share its cellular data connection with other Wi-Fi-enabled devices. ☒ Mobile Hotspot (Wi-Fi 2.4 GHz) ☐ Mobile Hotspot (Wi-Fi 5 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) EGPRS (8PSK)	GSM Voice: 12.5%; GPRS/EGPRS: 1 Slot: 12.5%; 2 Slots: 25%, 3 Slots: 37.5%, 4 Slots: 50%,
	GPRS Multi-Slot Class: ☐ 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 and II	UMTS Rel. 99 (Voice & Data) HSDPA (Rel. 7, CAT 24) HSUPA (Rel. 6, CAT 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

Upper limit (dB): 0.5 ~ -1.5		RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit
GSM850	Voice	33.0	33.5
	GPRS 1 slot	33.0	33.5
	GPRS 2 slots	30.5	31.0
	GPRS 3 slots	28.5	29.0
	GPRS 4 slots	26.5	27.0
	EGPRS 1 slot	27.0	27.5
	EGPRS 2 slots	27.0	27.5
	EGPRS 3 slots	25.5	26.0
	EGPRS 4 slots	24.5	25.0
GSM1900	Voice	29.5	30.0
	GPRS 1 slot	29.5	30.0
	GPRS 2 slots	27.5	28.0
	GPRS 3 slots	25.5	26.0
	GPRS 4 slots	24.0	24.5
	EGPRS 1 slot	26.0	26.5
	EGPRS 2 slots	25.0	25.5
	EGPRS 3 slots	24.0	24.5
	EGPRS 4 slots	23.0	23.5
W-CDMA Band V	R99	23.0	23.5
	HSDPA	22.5	23.0
	HSUPA	22.5	23.0
W-CDMA Band II	R99	22.0	22.5
	HSDPA	21.5	22.0
	HSUPA	22.0	22.5

Upper limit (dB): 0.5 ~ -1.5		RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit
WiFi 2.4 GHz	802.11b	17.0	17.5
	802.11g	13.0	13.5
	802.11n HT20	12.0	12.5
Bluetooth		10.91	11.41
Bluetooth LE		1.48	1.98

6.4. Simultaneous Transmission Condition

RF Exposure Condition	Capable Transmit Configurations
Head	1. GSM 850/1900 Voice + Wi-Fi 2.4GHz 2. GSM 850/1900 (GPRS/EDGE) + Wi-Fi 2.4GHz 3. WCDMA Band 2/5 + Wi-Fi 2.4GHz
Body-worn Accessory	1. GSM 850/1900 Voice + Wi-Fi 2.4GHz 2. GSM 850/1900 Voice + BT 3. GSM 850/1900 (GPRS/EDGE) + Wi-Fi 2.4GHz 4. GSM 850/1900 (GPRS/EDGE) + BT 5. WCDMA Band 2/5 + Wi-Fi 2.4GHz 6. WCDMA Band 2/5 + BT
Wireless Router (Hotspot)	1. GSM 850/1900 (GPRS/EDGE) + Wi-Fi 2.4GHz 2. WCDMA Band 2/5 + Wi-Fi 2.4GHz
Notes: 1. Wi-Fi only 2.4GHz supports Hotspot. 2. GPRS/EDGE and WCDMA support Hotspot. 3. VoIP is supported in WCDMA and GPRS. 4. Wi-Fi 2.4 GHz Radio cannot transmit simultaneously with Bluetooth Radio.	

7. RF Exposure Conditions (Test Configurations)

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

7.1. Head

For WWAN and Wi-Fi

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

7.2. Body-worn Accessory

For WWAN

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

For Wi-Fi

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

7.3. Wireless Router (Hotspot) & Wi-Fi Direct (2.4GHz only)

For WWAN

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	<25 mm	Yes	
Front	<25 mm	Yes	
Edge 1 (Top)	115 mm	No	SAR is not required because the distance from the antenna to the edge is > 25 mm as per KDB 941225 D06 Hot Spot SAR
Edge 2 (Right)	10 mm	Yes	
Edge 3 (Bottom)	0 mm	Yes	
Edge 4 (Left)	10 mm	Yes	

For Wi-Fi (2.4GHz only)

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	<25 mm	Yes	
Front	<25 mm	Yes	
Edge 1 (Top)	0 mm	Yes	
Edge 2 (Right)	0 mm	Yes	
Edge 3 (Bottom)	105 mm	No	SAR is not required because the distance from the antenna to the edge is > 25 mm as per KDB 648474 D04 Handset SAR
Edge 4 (Left)	55 mm	No	SAR is not required because the distance from the antenna to the edge is > 25 mm as per KDB 648474 D04 Handset SAR

8. Conducted Output Power Measurements

8.1. GSM850 and GSM1900

GSM850 Measured Results

Band	Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Burst Pwr (dBm)	Frame Pwr (dBm)
850	GSM (Voice)	CS1	1	128	824.2	32.6	23.6
				190	836.6	32.5	23.5
				251	848.8	32.5	23.5
	GPRS (GMSK)	CS1	1	128	824.2	32.6	23.6
				190	836.6	32.5	23.5
				251	848.8	32.5	23.4
			2	128	824.2	30.3	24.3
				190	836.6	30.1	24.1
				251	848.8	30.0	24.0
			3	128	824.2	28.4	24.1
				190	836.6	28.4	24.1
				251	848.8	28.4	24.1
			4	128	824.2	26.8	23.8
				190	836.6	26.6	23.6
				251	848.8	26.7	23.7
	EGPRS (8PSK)	MCS5	1	128	824.2	27.5	18.5
				190	836.6	27.5	18.5
				251	848.8	27.5	18.5
			2	128	824.2	26.7	20.7
				190	836.6	26.6	20.6
				251	848.8	26.7	20.7
			3	128	824.2	24.1	19.8
				190	836.6	24.0	19.7
				251	848.8	24.1	19.8
			4	128	824.2	23.8	20.8
				190	836.6	23.7	20.7
				251	848.8	23.7	20.7

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
- SAR is not required for EGPRS (8PSK) mode because its output power is less than that of GPRS Mode

GSM1900 Measured Results

Band	Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Burst Pwr (dBm)	Frame Pwr (dBm)
1900	GSM (Voice)	CS1	1	512	1850.2	30.0	21.0
				661	1880.0	30.0	21.0
				810	1909.8	30.0	21.0
	GPRS (GMSK)	CS1	1	512	1850.2	30.0	21.0
				661	1880.0	30.0	21.0
				810	1909.8	30.0	21.0
			2	512	1850.2	27.4	21.4
				661	1880.0	27.0	21.0
				810	1909.8	27.4	21.4
			3	512	1850.2	25.2	20.9
				661	1880.0	24.7	20.4
				810	1909.8	25.3	21.0
			4	512	1850.2	24.0	21.0
				661	1880.0	23.5	20.5
				810	1909.8	24.0	21.0
	EGPRS (8PSK)	MCS5	1	512	1850.2	26.5	17.5
				661	1880.0	26.0	17.0
				810	1909.8	26.5	17.5
			2	512	1850.2	25.5	19.5
				661	1880.0	25.3	19.3
				810	1909.8	25.5	19.5
			3	512	1850.2	23.0	18.7
				661	1880.0	22.5	18.2
				810	1909.8	23.1	18.8
			4	512	1850.2	22.7	19.7
				661	1880.0	22.3	19.3
				810	1909.8	22.8	19.8

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
- SAR is not required for EGPRS (8PSK) mode because its output power is less than that of GPRS Mode

8.2. W-CDMA Band V and II

Release 99

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

Mode	Subtest	Rel99
WCDMA General Settings	Loopback Mode	Test Mode 1
	Rel99 RMC	12.2kbps RMC
	Power Control Algorithm	Algorithm2
	β_c/β_d	8/15

Measured Results

Band	Mode	UL Ch No.	Freq. (MHz)	Avg Pwr (dBm)
W-CDMA Band V	Rel 99 (RMC, 12.2 kbps)	4132	826.4	22.9
		4183	836.6	22.8
		4233	846.6	22.8
W-CDMA Band II	Rel 99 (RMC, 12.2 kbps)	9262	1852.4	22.4
		9400	1880.0	22.5
		9538	1907.6	22.4

HSDPA

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

	Mode	HSDPA	HSDPA	HSDPA	HSDPA
	Subtest	1	2	3	4
W-CDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set1			
	Power Control Algorithm	Algorithm 2			
	β_c	2/15	12/15	15/15	15/15
	β_d	15/15	15/15	8/15	4/15
	Bd (SF)	64			
	β_c/β_d	2/15	12/15	15/8	15/4
	β_{hs}	4/15	24/15	30/15	30/15
HSDPA Specific Settings	MPR (dB)	0	1	1.5	1.5
	D_{ACK}	8			
	D_{NAK}	8			
	DCQI	8			
	Ack-Nack repetition factor	3			
	CQI Feedback (Table 5.2B.4)	4ms			
	CQI Repetition Factor (Table 5.2B.4)	2			
	$A_{hs} = \beta_{hs}/\beta_c$	30/15			

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

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

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

Measured Results

Band	Mode	UL Ch No.	Freq. (MHz)	Avg Pwr (dBm)
W-CDMA Band V	Subtest 1	4132	826.4	22.0
		4183	836.6	21.9
		4233	846.6	21.9
	Subtest 2	4132	826.4	21.9
		4183	836.6	21.8
		4233	846.6	21.8
	Subtest 3	4132	826.4	21.4
		4183	836.6	21.4
		4233	846.6	21.3
	Subtest 4	4132	826.4	21.3
		4183	836.6	21.3
		4233	846.6	21.4
W-CDMA Band II	Subtest 1	9262	1852.4	20.0
		9400	1880.0	20.5
		9538	1907.6	20.2
	Subtest 2	9262	1852.4	20.0
		9400	1880.0	20.4
		9538	1907.6	20.1
	Subtest 3	9262	1852.4	20.0
		9400	1880.0	20.4
		9538	1907.6	20.2
	Subtest 4	9262	1852.4	20.0
		9400	1880.0	20.3
		9538	1907.6	20.3

HSPA (HSDPA & HSUPA)

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

	Mode	HSPA	HSPA	HSPA	HSPA	HSPA
	Subtest	1	2	3	4	5
WCDMA General Settings	Loopback Mode	Test Mode 1				
	Rel99 RMC	12.2kbps RMC				
	HSDPA FRC	H-Set1				
	HSUPA Test	HSUPA Loopback				
	Power Control Algorithm	Algorithm2				
	β_c	11/15	6/15	15/15	2/15	15/15
	β_d	15/15	15/15	9/15	15/15	15/15
	β_{ec}	209/225	12/15	30/15	2/15	24/15
	β_c/β_d	11/15	6/15	15/9	2/15	15/15
	β_{hs}	22/15	12/15	30/15	4/15	30/15
	β_{ed}	1309/225	94/75	47/15 47/15	56/75	134/15
	CM (dB)	1.0	3.0	2.0	3.0	1.0
	MPR (dB)	0	2	1	2	0
HSDPA Specific Settings	DACK	8				
	DNAK	8				
	DCQI	8				
	Ack-Nack repetition factor	3				
	CQI Feedback (Table 5.2B.4)	4ms				
	CQI Repetition Factor (Table 5.2B.4)	2				
	Ahs = β_{hs}/β_c	30/15				
HSUPA Specific Settings	D E-DPCCH	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	E-TFCI 11 E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO 23 E-TFCI 75 E-TFCI PO 26 E-TFCI 81 E-TFCI PO 27		E-TFCI 11 E-TFCI PO 4 E-TFCI 92 E-TFCI PO 18		E-TFCI 11 E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO 23 E-TFCI 75 E-TFCI PO 26 E-TFCI 81 E-TFCI PO 27

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

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

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

Measured Results

Band	Mode	UL Ch No.	Freq. (MHz)	Avg Pwr (dBm)
W-CDMA Band V	Subtest 1	4132	826.4	21.0
		4183	836.6	21.0
		4233	846.6	21.8
	Subtest 2	4132	826.4	21.4
		4183	836.6	21.3
		4233	846.6	21.3
	Subtest 3	4132	826.4	21.7
		4183	836.6	21.7
		4233	846.6	21.6
	Subtest 4	4132	826.4	21.9
		4183	836.6	21.8
		4233	846.6	21.7
W-CDMA Band II	Subtest 1	4132	826.4	21.9
		4183	836.6	21.9
		4233	846.6	22.0
	Subtest 2	9262	1852.4	21.2
		9400	1880.0	21.5
		9538	1907.6	21.4
	Subtest 3	9262	1852.4	20.7
		9400	1880.0	21.0
		9538	1907.6	20.7
	Subtest 4	9262	1852.4	21.2
		9400	1880.0	21.2
		9538	1907.6	21.4
	Subtest 5	9262	1852.4	21.2
		9400	1880.0	21.4
		9538	1907.6	21.3
W-CDMA Band II	Subtest 1	9262	1852.4	20.5
		9400	1880.0	21.0
		9538	1907.6	20.9

8.3. Wi-Fi (2.4 GHz Band)

Measured Results

Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	Avg Pwr (dBm)	SAR Test (Yes/No)
2.4 (DTS)	802.11b	1 Mbps	1	2412	17.5	Yes
			6	2437	17.5	
			11	2462	17.1	
	802.11g	6 Mbps	1	2412	13.5	No
			6	2437	13.4	
			11	2462	13.5	
	802.11n (HT20)	MCS0	1	2412	12.4	No
			6	2437	12.4	
			11	2462	12.5	

Note(s):

- Per KDB 248227 D01, SAR is not required for 802.11g/HT20 channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11b channels.

Power measurements to determine worst-case data rates

Mode	Ch #	Freq. (MHz)	Data Rate	Avg Pwr (dBm)	SAR test (Yes/No)
802.11b	6	2437	1 Mbps	17.5	Yes
			2 Mbps	17.3	No
			5.5 Mbps	17.3	No
			11 Mbps	17.4	No

8.4. Bluetooth

Maximum tune-up tolerance limit is 11.41 dBm from the rated nominal maximum output power. This power level qualifies for exclusion of SAR testing.

9. Dielectric Property Measurements

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

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

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

9.1. Tissue Dielectric Parameters

FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

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

IEEE Std 1528-2013

Refer to Table 3 within the IEEE Std 1528-2013

9.2. Dielectric Property Measurements Results

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

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

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

SAR Lab D

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
9/16/2014	Head 835	e'	42.6800	Relative Permittivity (ϵ_r):	42.68	41.50	2.84	5
		e"	18.7700	Conductivity (σ):	0.87	0.90	-3.17	5
	Head 820	e'	42.9800	Relative Permittivity (ϵ_r):	42.98	41.60	3.31	5
		e"	18.7500	Conductivity (σ):	0.85	0.90	-4.85	5
	Head 850	e'	42.4700	Relative Permittivity (ϵ_r):	42.47	41.50	2.34	5
		e"	18.9000	Conductivity (σ):	0.89	0.92	-2.38	5
9/16/2014	Body 835	e'	54.3600	Relative Permittivity (ϵ_r):	54.36	55.20	-1.52	5
		e"	20.5600	Conductivity (σ):	0.95	0.97	-1.59	5
	Body 820	e'	54.5900	Relative Permittivity (ϵ_r):	54.59	55.28	-1.24	5
		e"	20.5600	Conductivity (σ):	0.94	0.97	-3.20	5
	Body 850	e'	54.2000	Relative Permittivity (ϵ_r):	54.20	55.16	-1.74	5
		e"	20.5500	Conductivity (σ):	0.97	0.99	-1.61	5
9/22/2014	Head 835	e'	42.3800	Relative Permittivity (ϵ_r):	42.38	41.50	2.12	5
		e"	19.1000	Conductivity (σ):	0.89	0.90	-1.47	5
	Head 820	e'	42.6200	Relative Permittivity (ϵ_r):	42.62	41.60	2.45	5
		e"	19.1600	Conductivity (σ):	0.87	0.90	-2.77	5
	Head 850	e'	42.2200	Relative Permittivity (ϵ_r):	42.22	41.50	1.73	5
		e"	19.0700	Conductivity (σ):	0.90	0.92	-1.50	5
9/22/2014	Body 835	e'	53.0800	Relative Permittivity (ϵ_r):	53.08	55.20	-3.84	5
		e"	20.5200	Conductivity (σ):	0.95	0.97	-1.78	5
	Body 820	e'	53.2600	Relative Permittivity (ϵ_r):	53.26	55.28	-3.65	5
		e"	20.6300	Conductivity (σ):	0.94	0.97	-2.88	5
	Body 850	e'	52.9300	Relative Permittivity (ϵ_r):	52.93	55.16	-4.04	5
		e"	20.4900	Conductivity (σ):	0.97	0.99	-1.90	5

SAR Lab F

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
10/6/2014	Head 2450	e'	38.2000	Relative Permittivity (ϵ_r):	38.20	39.20	-2.55	5
		e"	13.4300	Conductivity (σ):	1.83	1.80	1.64	5
	Head 2410	e'	38.3600	Relative Permittivity (ϵ_r):	38.36	39.28	-2.34	5
		e"	13.1500	Conductivity (σ):	1.76	1.76	0.10	5
	Head 2475	e'	38.1700	Relative Permittivity (ϵ_r):	38.17	39.17	-2.55	5
		e"	13.4700	Conductivity (σ):	1.85	1.83	1.46	5
10/6/2014	Body 2450	e'	50.6600	Relative Permittivity (ϵ_r):	50.66	52.70	-3.87	5
		e"	14.5500	Conductivity (σ):	1.98	1.95	1.65	5
	Body 2410	e'	50.8400	Relative Permittivity (ϵ_r):	50.84	52.76	-3.64	5
		e"	14.3900	Conductivity (σ):	1.93	1.91	1.09	5
	Body 2475	e'	50.6000	Relative Permittivity (ϵ_r):	50.60	52.67	-3.93	5
		e"	14.6600	Conductivity (σ):	2.02	1.99	1.63	5

SAR Lab H

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
9/16/2014	Head 1900	e'	39.3900	Relative Permittivity (ϵ_r):	39.39	40.00	-1.53	5
		e"	13.7200	Conductivity (σ):	1.45	1.40	3.53	5
	Head 1850	e'	39.5200	Relative Permittivity (ϵ_r):	39.52	40.00	-1.20	5
		e"	13.6700	Conductivity (σ):	1.41	1.40	0.44	5
	Head 1910	e'	39.3400	Relative Permittivity (ϵ_r):	39.34	40.00	-1.65	5
		e"	13.7200	Conductivity (σ):	1.46	1.40	4.08	5
9/16/2014	Body 1900	e'	51.9600	Relative Permittivity (ϵ_r):	51.96	53.30	-2.51	5
		e"	14.9500	Conductivity (σ):	1.58	1.52	3.91	5
	Body 1850	e'	52.0400	Relative Permittivity (ϵ_r):	52.04	53.30	-2.36	5
		e"	14.9500	Conductivity (σ):	1.54	1.52	1.17	5
	Body 1910	e'	51.9300	Relative Permittivity (ϵ_r):	51.93	53.30	-2.57	5
		e"	14.9500	Conductivity (σ):	1.59	1.52	4.46	5
9/29/2014	Head 1900	e'	39.3000	Relative Permittivity (ϵ_r):	39.30	40.00	-1.75	5
		e"	13.5500	Conductivity (σ):	1.43	1.40	2.25	5
	Head 1850	e'	39.4900	Relative Permittivity (ϵ_r):	39.49	40.00	-1.28	5
		e"	13.5100	Conductivity (σ):	1.39	1.40	-0.73	5
	Head 1910	e'	39.2700	Relative Permittivity (ϵ_r):	39.27	40.00	-1.82	5
		e"	13.5700	Conductivity (σ):	1.44	1.40	2.94	5
9/29/2014	Body 1900	e'	51.0700	Relative Permittivity (ϵ_r):	51.07	53.30	-4.18	5
		e"	14.9000	Conductivity (σ):	1.57	1.52	3.56	5
	Body 1850	e'	51.2000	Relative Permittivity (ϵ_r):	51.20	53.30	-3.94	5
		e"	14.9100	Conductivity (σ):	1.53	1.52	0.90	5
	Body 1910	e'	51.0500	Relative Permittivity (ϵ_r):	51.05	53.30	-4.22	5
		e"	14.9000	Conductivity (σ):	1.58	1.52	4.11	5
10/6/2014	Body 1900	e'	51.1100	Relative Permittivity (ϵ_r):	51.11	53.30	-4.11	5
		e"	14.0700	Conductivity (σ):	1.49	1.52	-2.21	5
	Body 1850	e'	51.2300	Relative Permittivity (ϵ_r):	51.23	53.30	-3.88	5
		e"	14.1100	Conductivity (σ):	1.45	1.52	-4.51	5
	Body 1910	e'	51.1100	Relative Permittivity (ϵ_r):	51.11	53.30	-4.11	5
		e"	14.0800	Conductivity (σ):	1.50	1.52	-1.62	5

10. System Check

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

10.1. Reference Target SAR Values

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

System Dipole	Serial No.	Cal. Date	Freq. (MHz)	Target SAR Values (W/kg)		
				1g/10g	Head	Body
D835V2	4d117	5/16/2014	835	1g	9.23	9.61
				10g	5.98	6.31
D835V2	4d002	11/15/2013	835	1g	9.49	9.43
				10g	6.18	6.21
D1900V2	5d140	4/23/2014	1900	1g	40.1	40.2
				10g	21.0	21.3
D2450V2	748	2/18/2014	2450	1g	51.6	50.7
				10g	24.0	23.7

10.2. System Check Results

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

SAR Lab D

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			
9/16/2014	D835V2	4d117	Body	1g	0.944	9.440	9.61	-1.77
				10g	0.623	6.230	6.31	-1.27
9/16/2014	D835V2	4d117	Head	1g	0.894	8.940	9.23	-3.14
				10g	0.585	5.850	5.98	-2.17
9/22/2014	D835V2	4d002	Body	1g	0.938	9.380	9.43	-0.53
				10g	0.617	6.170	6.21	-0.64
9/22/2014	D835V2	4d002	Head	1g	0.910	9.100	9.49	-4.11
				10g	0.594	5.940	6.18	-3.88

SAR Lab F

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	748	Head	1g	5.02	50.2	51.6	-2.71
				10g	2.27	22.7	24.0	-5.42
10/6/2014	D2450V2	748	Body	1g	5.35	53.5	50.7	5.52
				10g	2.48	24.8	23.7	4.64

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			
9/16/2014	D1900V2	5d140	Body	1g	4.32	43.20	40.2	7.46
				10g	2.23	22.30	21.3	4.69
9/16/2014	D1900V2	5d140	Head	1g	4.11	41.10	40.1	2.49
				10g	2.10	21.00	21.0	0.00
9/29/2014	D1900V2	5d140	Head	1g	3.80	38.00	40.1	-5.24
				10g	1.96	19.60	21.0	-6.67
9/29/2014	D1900V2	5d140	Body	1g	3.92	39.20	40.2	-2.49
				10g	2.03	20.30	21.3	-4.69
10/7/2014	D1900V2	5d140	Body	1g	4.27	42.70	40.2	6.22
				10g	2.21	22.10	21.3	3.76

11. Measured and Reported (Scaled) SAR Results

SAR Test Reduction criteria are as follows:

KDB 447498 D01 General RF Exposure Guidance:

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

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

KDB 648474 D04 Handset SAR:

With headset attached, when the reported SAR for body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.

KDB 941225 D01 SAR test for 3G devices:

Body SAR is also measured for HSPA when the maximum average output of each RF channel with HSPA active is at least $\frac{1}{4}$ dB higher than that measured without HSPA using 12.2 kbps RMC or the maximum SAR for 12.2 kbps RMC is above 75% of the SAR limit. Body SAR for HSPA is measured with E-DCH Sub-test 5, using H-Set 1 and QPSK for FRC and a 12.2 kbps RMC configured in Test Loop Mode 1 with power control algorithm 2.

11.1. GSM850

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled	
Head	Voice	0	Left Touch	190	836.6	33.5	32.5	0.175	0.220	0.120	0.151	1
			Left Tilt	190	836.6	33.5	32.5	0.056	0.070	0.041	0.052	
			Right Touch	190	836.6	33.5	32.5	0.148	0.186	0.110	0.138	
			Right Tilt	190	836.6	33.5	32.5	0.053	0.067	0.040	0.050	
Head VoIP	GPRS 2 Slots	0	Left Touch	190	836.6	31.0	30.1	0.166	0.204	0.113	0.139	2
			Left Tilt	190	836.6	31.0	30.1	0.038	0.047	0.026	0.031	
			Right Touch	190	836.6	31.0	30.1	0.155	0.191	0.114	0.140	
			Right Tilt	190	836.6	31.0	30.1	0.055	0.068	0.042	0.051	
Body-worn	Voice	10	Rear	190	836.6	33.5	32.5	0.352	0.443	0.203	0.256	3
			Front	190	836.6	33.5	32.5	0.290	0.365	0.169	0.213	
Body-worn(VoIP) & Hotspot	GPRS 2 Slots	10	Rear	190	836.6	31.0	30.1	0.473	0.582	0.271	0.333	4
Front			190	836.6	31.0	30.1	0.399	0.491	0.231	0.284		
Hotspot			Edge 2	190	836.6	31.0	30.1	0.103	0.127	0.067	0.083	
			Edge 3	190	836.6	31.0	30.1	0.209	0.257	0.110	0.135	
			Edge 4	190	836.6	31.0	30.1	0.087	0.107	0.055	0.068	

11.2. GSM1900

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled	
Head	Voice	0	Left Touch	661	1880.0	30.0	30.0	0.151	0.151	0.090	0.090	5
			Left Tilt	661	1880.0	30.0	30.0	0.080	0.080	0.046	0.046	
			Right Touch	661	1880.0	30.0	30.0	0.110	0.110	0.065	0.065	
			Right Tilt	661	1880.0	30.0	30.0	0.061	0.061	0.038	0.038	
Head VoIP	GPRS 2 Slots	0	Left Touch	661	1880.0	28.0	27.0	0.145	0.183	0.086	0.108	6
			Left Tilt	661	1880.0	28.0	27.0	0.079	0.099	0.044	0.056	
			Right Touch	661	1880.0	28.0	27.0	0.120	0.151	0.072	0.091	
			Right Tilt	661	1880.0	28.0	27.0	0.064	0.080	0.040	0.050	
Body-worn	Voice	10	Rear	661	1880.0	30.0	30.0	0.506	0.506	0.294	0.294	7
			Front	661	1880.0	30.0	30.0	0.440	0.440	0.258	0.258	
Body-worn(VoIP) & Hotspot	GPRS 2 Slots	10	Rear	661	1880.0	28.0	27.0	0.424	0.534	0.249	0.313	
Front			661	1880.0	28.0	27.0	0.393	0.495	0.230	0.290		
Hotspot			Edge 2	661	1880.0	28.0	27.0	0.087	0.110	0.050	0.063	
			Edge 3	512	1850.2	28.0	27.4	0.809	0.929	0.443	0.509	
				661	1880.0	28.0	27.0	0.682	0.859	0.375	0.472	
				810	1909.8	28.0	27.4	0.835	0.959	0.452	0.519	8
Edge 4			661	1880.0	28.0	27.0	0.126	0.159	0.070	0.088		

11.3. W-CDMA Band V

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled	
Head	Rel 99 RMC	0	Left Touch	4183	836.6	23.5	22.8	0.198	0.233	0.134	0.157	9
			Left Tilt	4183	836.6	23.5	22.8	0.059	0.069	0.046	0.054	
			Right Touch	4183	836.6	23.5	22.8	0.128	0.150	0.093	0.109	
			Right Tilt	4183	836.6	23.5	22.8	0.053	0.063	0.041	0.049	
Body-worn & Hotspot	Rel 99 RMC	10	Rear	4183	836.6	23.5	22.8	0.448	0.526	0.264	0.310	10
			Front	4183	836.6	23.5	22.8	0.426	0.501	0.282	0.331	
Hotspot	Rel 99 RMC	10	Edge 2	4183	836.6	23.5	22.8	0.117	0.137	0.075	0.088	
			Edge 3	4183	836.6	23.5	22.8	0.205	0.241	0.110	0.129	
			Edge 4	4183	836.6	23.5	22.8	0.107	0.126	0.068	0.080	

11.4. W-CDMA Band II

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled	
Head	Rel 99 RMC	0	Left Touch	9400	1880.0	22.5	22.5	0.276	0.276	0.170	0.170	11
			Left Tilt	9400	1880.0	22.5	22.5	0.121	0.121	0.072	0.072	
			Right Touch	9400	1880.0	22.5	22.5	0.225	0.225	0.135	0.135	
			Right Tilt	9400	1880.0	22.5	22.5	0.105	0.105	0.068	0.068	
Body-worn & Hotspot	Rel 99 RMC	10	Rear	9400	1880.0	22.5	22.5	0.682	0.682	0.383	0.383	12
			Front	9400	1880.0	22.5	22.5	0.552	0.552	0.321	0.321	
Hotspot	Rel 99 RMC	10	Edge 2	9400	1880.0	22.5	22.5	0.126	0.126	0.069	0.069	
			Edge 3	9262	1852.4	22.5	22.4	0.908	0.929	0.496	0.508	
				9400	1880.0	22.5	22.5	1.090	1.090	0.593	0.593	13
				9538	1907.6	22.5	22.4	1.040	1.064	0.560	0.573	
			Edge 4	9400	1880.0	22.5	22.5	0.212	0.212	0.118	0.118	

11.5. Wi-Fi (DTS Band)

Freq. Band	RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
							Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled	
2.4 GHz	Head	802.11b 1 Mbps	0	Left Touch	6	2437.0	17.5	17.5	0.713	0.713	0.308	0.308	14
				Left Tilt	6	2437.0	17.5	17.5	0.505	0.505	0.210	0.210	
				Right Touch	6	2437.0	17.5	17.5	0.395	0.395	0.197	0.197	
				Right Tilt	6	2437.0	17.5	17.5	0.288	0.288	0.144	0.144	
	Body-worn & Hotspot	802.11b 1 Mbps	10	Rear	6	2437.0	17.5	17.5	0.100	0.100	0.049	0.049	15
				Front	6	2437.0	17.5	17.5	0.085	0.085	0.050	0.050	
	Hotspot	802.11b 1 Mbps	10	Edge 1	6	2437.0	17.5	17.5	0.093	0.093	0.054	0.054	
				Edge 2	6	2437.0	17.5	17.5	0.057	0.057	0.029	0.029	

11.6. Bluetooth

11.6.1. Standalone SAR Test Exclusion Considerations

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

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$, for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

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

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

Body-worn Accessory Exposure Conditions

Max. tune-up tolerance limit		Min. test separation distance (mm)	Frequency (GHz)	Result
(dBm)	(mW)			
11.41	13.84	10	2.480	2.2

Conclusion:

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

11.6.2. Estimated SAR

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

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

Estimated SAR Result for Body-worn Accessory Conditions:

Test Configuration	Max. tune-up tolerance limit (mW)	Min. test separation distance (mm)	Frequency (GHz)	Estimated 1-g SAR (W/kg)
Rear/Front	13.84	10	2.480	0.291

12. SAR Measurement Variability

In accordance with published RF Exposure KDB procedure 865664 D01 SAR measurement 100 MHz to 6 GHz v01. These additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

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

12.1. The Highest Measured SAR Configuration in Each Frequency Band

Frequency Band (MHz)	Air Interface	Head (W/kg)	Body-worn Accessory (W/kg)	Wireless Router (Hotspot) (W/kg)	Repeated SAR (Yes/No)
850	GSM 850	N/A	N/A	N/A	No
	WCDMA Band V	N/A	N/A	N/A	No
1900	GSM 1900	N/A	N/A	N/A	No
	WCDMA Band II	N/A	N/A	1.09	Yes
2400	Wi-Fi 802.11b/g/n	N/A	N/A	N/A	No

12.2. Repeated Measurement Results

Head

N/A

Body-worn Accessory

N/A

Wireless Router (Hotspot)

Frequency band	Test Position	Mode	Ch #.	Freq. (MHz)	Meas. SAR (W/kg)		Largest to Smallest SAR Ratio	Note
					Original	Repeated		
W-CDMA Band II	Edge 3	Rel 99 RMC 12.2 kbps	9400	1880.0	1.090	1.080	1.01	1

13. Simultaneous Transmission SAR Analysis

KDB 447498 D01 General RF Exposure Guidance v05, introduces a new formula for calculating the SAR to Peak Location Ratio (SPLSR) between pairs of simultaneously transmitting antennas:

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

Where:

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

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

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

A new threshold of 0.04 is also introduced in the draft KDB. Thus, in order for a pair of simultaneous transmitting antennas with the sum of 1-g SAR > 1.6 W/kg to qualify for exemption from Simultaneous Transmission SAR measurements, it has to satisfy the condition of:

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

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

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario			Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① GSM850	② Wi-Fi(DTS)	③ Bluetooth		
Head	Left Touch	① + ②	0.220	0.713		0.933	No
	Left Tilt	① + ②	0.070	0.505		0.575	No
	Right Touch	① + ②	0.191	0.395		0.586	No
	Right Tilt	① + ②	0.068	0.288		0.356	No
Body-worn Accessory & Hotspot	Rear	① + ②	0.582	0.100		0.682	No
		① + ③	0.582		0.291	0.873	No
	Front	① + ②	0.491	0.085		0.576	No
		① + ③	0.491		0.291	0.782	No
Hotspot	Edge 2	① + ②	0.127	0.057		0.184	No

SAR to Peak Location Separation Ratio (SPLSR)

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

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

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario			Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① GSM1900	② Wi-Fi(DTS)	③ Bluetooth		
Head	Left Touch	① + ②	0.183	0.713		0.896	No
	Left Tilt	① + ②	0.099	0.505		0.604	No
	Right Touch	① + ②	0.151	0.395		0.546	No
	Right Tilt	① + ②	0.080	0.288		0.368	No
Body-worn Accessory & Hotspot	Rear	① + ②	0.534	0.100		0.634	No
		① + ③	0.534		0.291	0.825	No
	Front	① + ②	0.495	0.085		0.580	No
		① + ③	0.495		0.291	0.786	No
Hotspot	Edge 2	① + ②	0.110	0.057		0.167	No

SAR to Peak Location Separation Ratio (SPLSR)

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

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

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario			Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① WCDMA V	② Wi-Fi(DTS)	③ Bluetooth		
Head	Left Touch	① + ②	0.233	0.713		0.946	No
	Left Tilt	① + ②	0.069	0.505		0.574	No
	Right Touch	① + ②	0.150	0.395		0.545	No
	Right Tilt	① + ②	0.063	0.288		0.351	No
Body-worn Accessory & Hotspot	Rear	① + ②	0.526	0.100		0.626	No
		① + ③	0.526		0.291	0.817	No
	Front	① + ②	0.501	0.085		0.586	No
		① + ③	0.501		0.291	0.792	No
Hotspot	Edge 2	① + ②	0.137	0.057		0.194	No

SAR to Peak Location Separation Ratio (SPLSR)

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

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

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario			Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① WCDMA II	② Wi-Fi(DTS)	③ Bluetooth		
Head	Left Touch	① + ②	0.276	0.713		0.989	No
	Left Tilt	① + ②	0.121	0.505		0.626	No
	Right Touch	① + ②	0.225	0.395		0.620	No
	Right Tilt	① + ②	0.105	0.288		0.393	No
Body-worn Accessory & Hotspot	Rear	① + ②	0.682	0.100		0.782	No
		① + ③	0.682		0.291	0.973	No
	Front	① + ②	0.552	0.085		0.637	No
		① + ③	0.552		0.291	0.843	No
Hotspot	Edge 2	① + ②	0.126	0.057		0.183	No

SAR to Peak Location Separation Ratio (SPLSR)

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

14. Appendixes

Refer to separated files for the following appendixes.

- 14.1. Photos and Antenna Locations**
- 14.2. System Performance Check Plots**
- 14.3. Highest SAR Test Plots**
- 14.4. Tissue Material Ingredients**
- 14.5. Calibration Certificate for E-Field Probe EX3DV4 - SN 3936**
- 14.6. Calibration Certificate for E-Field Probe EX3DV4 - SN 3989**
- 14.7. Calibration Certificate for E-Field Probe EX3DV4 - SN 3686**
- 14.8. Calibration Certificate for D2450V2 - SN 748**
- 14.9. Calibration Certificate for D835V2 - SN 4d117**
- 14.10. Calibration Certificate for D835V2 - SN 4d002**
- 14.11. Calibration Certificate for D1900V2 - SN 5d140**

END OF REPORT