SAR EVALUATION REPORT

CLASS II PERMISSIVE CHANGE

FCC 47 CFR § 2.1093
IEEE Std 1528-2013

For
GSM Phone + BT/BLE, DTS b/g/n

FCC ID: A3LSMJ105H
Model Name: SM-J105H/DD, SM-J105H/DS, SM-J105H, SM-J106H/DS

Report Number: 16K23808-S1V2
Issue Date: 9/19/2016

Prepared for
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ACCREDITED

TL-637

Revision History

Rev.	Date	Revisions	Revised By
V1	9/12/2016	Initial Issue	Sunghoon Kim
V2	9/19/2016	Added test Equipment and system check for modified SAR testing. -Revised Sec.4.3. and Sec.8.1. and Sec.8.2. -Revised Appendix C, E, F.	Sunghoon Kim

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1. Attestation of Test Results

Applicant Name	SAMSUNG ELECTRONICS CO.,LTD.				
FCC ID	A3LSMJ105H				
Model Name	SM-J105H/DD, SM-J105H/DS, SM-J105H, SM-J106H/DS				
Applicable Standards	FCC 47 CFR § 2.1093 Published RF exposure KDB procedures IEEE Std 1528-2013				
SAR Limits (W/Kg)					
Exposure Category	Peak spatial-average(1g of tissue)				
General population / Uncontrolled exposure	1.6				
The Highest Reported SAR (W/kg)					
RF Exposure Conditions		**Equipment Class**			
		Licensed	**DTS**	**U-NII**	**DSS (BT)**
Head		1.087	0.781	N/A	N/A
Body-worn*		0.919	0.107		
Hotspot/Wi-Fi Direct					
Simultaneous TX	Head	1.502			
	Body-worn*	1.026			
	Hotspot/ Wi-Fi Direct				

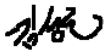
Note: 1) The Body-worn minimum separation distance is 15 mm. To cover both body-worn and hotspot RF exposure conditions testing was performed at a separation distance of 10 mm.

2) SM-J105H, SM-J105H/DD and SM-J105H/DS are same hardware, but for different number of SIM card slot. SM-J105H has one slot. SM-J105H/DD and SM-J105H/DS are dual SIM version. SM-J106H/DS is same hardware with Original models. But difference is memory capacity and added Flash LED part. So Spot checks for other models were performed to ensure that the SAR measurements for both devices are the same.

Date Tested	Original test : 12/14/2015 to 12/21/2015 Spot check test : 8/30/2016 to 9/9/2016
Test Results	Pass

UL Korea, Ltd. 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 Korea, Ltd. 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 Korea, Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Korea, Ltd. 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 IAS, any agency of the Federal Government, or any agency of any government.

Approved & Released By:	Prepared By:
	
Justin Park Senior Engineer UL Korea, Ltd. Suwon Laboratory	Sunghoon Kim Laboratory Engineer UL Korea, Ltd. Suwon Laboratory

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1.1. Introduction

This report referenced from the FCC ID: A3LSMJ105H (GSM 850, 1900, DTS)

(FCC 47 CFR § 2.1093, IEEE 1528-2013).

And the applicant takes full responsibility that the test data as referenced in this report represent compliance for this FCC ID..

1.2. Difference

The WWAN (GSM 850, 1900, WLAN) SAR measurement results from the original filling can be found in SAR test report 15K22503-S1V2, FCC ID A3LSMJ105H.

The difference is both original devices and modified devices that changes memory capacity and added Flash LED part.

1.3. Spot Check Verification Data

Band		Antenna	RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	RB Allocation	RB offest	Original models				Modified models				Deviation
											Power (dBm)		1-g SAR (W/kg)		Power (dBm)		1-g SAR (W/kg)		
											Tune-up limit	Meas.	Meas.	Scaled	Tune-up limit	Meas.	Meas.	Scaled	
GSM	850	Main	Body & Hotspot	GPRS 3 slpts	10	Rear	251	848.8	N/A	N/A	30.0	29.2	0.763	0.919	30.0	29.4	0.797	0.915	0%
GSM	1900	Main	Head	GPRS 3 slpts	0	Right Touch	810	1909.8	N/A	N/A	26.9	26.4	0.972	1.087	26.9	25.8	0.828	1.067	-2%
DTS	2.4GHz	Wi-Fi	Head	802.11b	0	Left Touch	11	2462.0	N/A	N/A	16.5	16.2	0.729	0.781	16.5	16.5	0.670	0.678	-13%

Note(s):

For each bands, if the highest SAR of the modified devices for worst exposure (head or Body-worn or Hotspot) is larger than the highest SAR for original devices for worst configuration, it change to modified SAR result. and also additional exposure was SAR tested if modified SAR is larger than original SAR in worst exposure.

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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 802.11 Wi-Fi SAR v02r02
- 447498 D01 General RF Exposure Guidance v06
- 648474 D04 Handset SAR v01r03
- 690783 D01 SAR Listings on Grants v01r03
- 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04
- 865664 D02 RF Exposure Reporting v01r02
- 941225 D01 3G SAR Procedures v03r01
- 941225 D06 Hotspot Mode v02r01

3. Facilities and Accreditation

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

Suwon
SAR 1 Room
SAR 2 Room
SAR 3 Room

UL Korea, Ltd. is accredited by IAS, Laboratory Code TL-637.
The full scope of accreditation can be viewed at http://www.iasonline.org/PDF/TL/TL-637.pdf.

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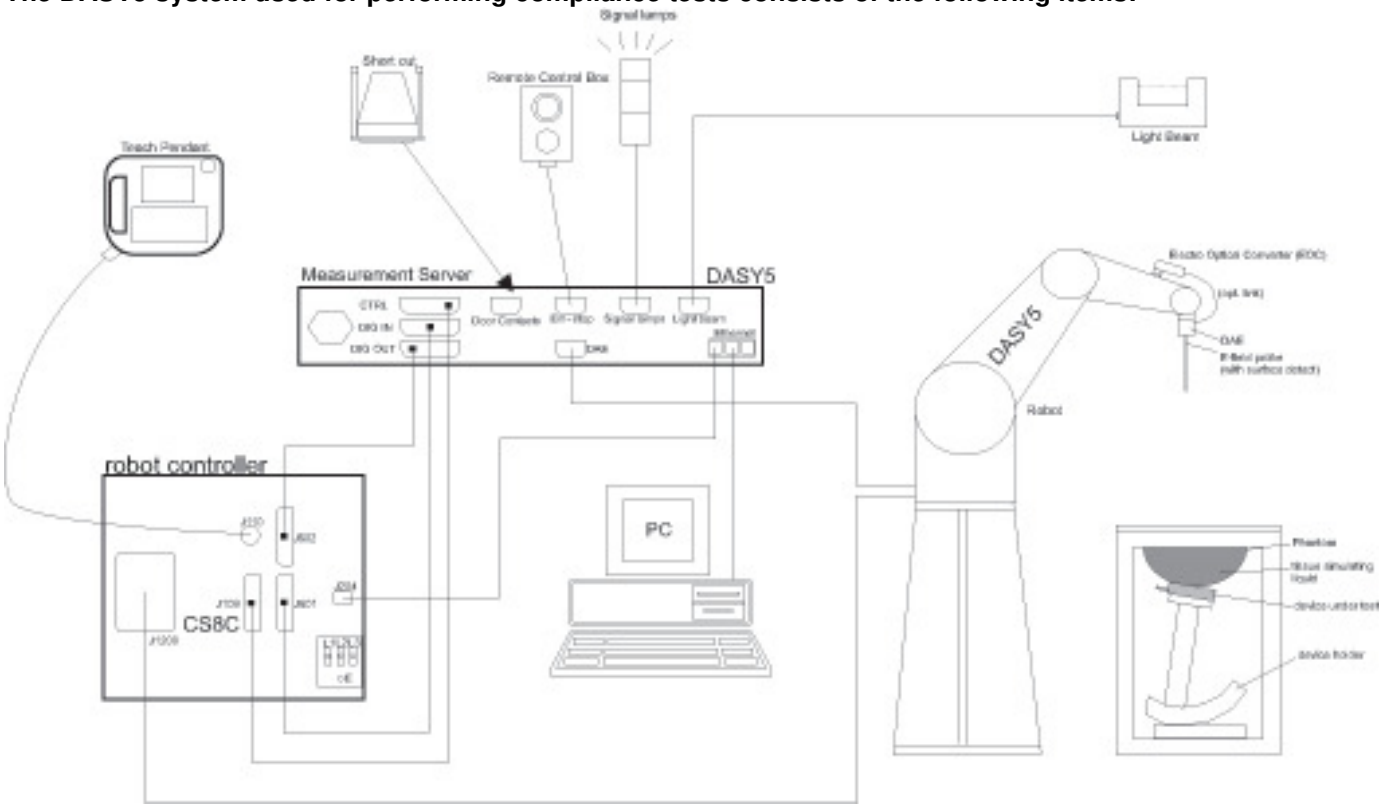
4. SAR Measurement System & Test Equipment

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.

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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

<table>
<tr><td></td><td>≤ 3 GHz</td><td>> 3 GHz</td></tr>
<tr><td>Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 ± 1 mm</td><td>½·δ·ln(2) ± 0.5 mm</td></tr>
<tr><td>Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td rowspan="2">Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}</td><td>≤ 2 GHz: ≤ 15 mm
2 – 3 GHz: ≤ 12 mm</td><td>3 – 4 GHz: ≤ 12 mm
4 – 6 GHz: ≤ 10 mm</td></tr>
<tr><td colspan="2">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.</td></tr>
</table>

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Step 3: Zoom Scan

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

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

			≤ 3 GHz	> 3 GHz
Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}			≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	≤ 1.5·$\Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm

Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.

* When zoom scan is required and the *reported* SAR from the area scan based *1-g SAR estimation* procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.

Step 4: Power drift measurement

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

Step 5: Z-Scan (FCC only)

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

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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	E5071C	MY46522054	8-18-2016
				8-18-2017
Dielectric Assessment Kit	SPEAG	DAK-3.5	1196	8-4-2016
				7-26-2017
Shorting block	SPEAG	DAK-3.5 Short	SM DAK 200 BA	N/A
Thermometer	LKM	DTM3000	3424	8-19-2016
				8-17-2017
Thermometer	Lutron	MHB-382SD	AH.91478	8-12-2016
				8-10-2017

System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
MXG Analog Signal Generator	Agilent	N5181A	MY50145882	8-18-2016
				8-16-2017
Power Sensor	Agilent	U2000A	MY54260010	8-18-2016
				8-17-2017
Power Sensor	Agilent	U2000A	MY54260007	8-18-2016
				8-17-2017
Power Amplifier	EXODUS	1410025-AMP2027-10003	10003	8-18-2016
				8-17-2017
Directional Coupler	Agilent	772D	MY52180193	8-18-2016
				8-17-2017
Directional Coupler	Agilent	778D	MY52180432	8-18-2016
				8-17-2017
Low Pass Filter	MICROLAB	LA-15N	03943	8-18-2016
				8-17-2017
Low Pass Filter	FILTRON	L14012FL	1410003S	8-18-2016
				8-17-2017
Attenuator	Agilent	8491B/003	MY39269292	8-18-2016
				8-17-2017
Attenuator	Agilent	8491B/010	MY39269315	8-18-2016
				8-17-2017
Attenuator	Agilent	8491B/020	MY39269298	8-18-2016
				8-17-2017
E-Field Probe (SAR1)	SPEAG	EX3DV4	7314	9-25-2016
E-Field Probe (SAR2)	SPEAG	EX3DV4	7376	9-2-2016
E-Field Probe (SAR3)	SPEAG	EX3DV4	7330	2-12-2016
E-Field Probe (SAR2)	SPEAG	EX3DV4	7330	2-24-2017
E-Field Probe (SAR3)	SPEAG	EX3DV4	7313	12-30-2016
Data Acquisition Electronics (SAR1)	SPEAG	DAE4	1447	9-23-2016
Data Acquisition Electronics (SAR2)	SPEAG	DAE4	1468	9-15-2016
Data Acquisition Electronics (SAR3)	SPEAG	DAE4	1494	11-11-2016
Data Acquisition Electronics (SAR2)	SPEAG	DAE4	912	11-19-2016
Data Acquisition Electronics (SAR3)	SPEAG	DAE4	1494	7-18-2017

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System Check (Continued)

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
System Validation Dipole	SPEAG	D835V2	4d194	9-17-2016
System Validation Dipole	SPEAG	D835V2	4d174	9-30-2016
System Validation Dipole	SPEAG	D1900V2	5d199	2-6-2016
System Validation Dipole	SPEAG	D2450V2	960	2-5-2016
System Validation Dipole	SPEAG	D2450V2	939	9-28-2016
Thermometer (SAR1)	Lutron	MHB-382SD	AH.91463	8-12-2016
				8-10-2017
Thermometer (SAR2)	Lutron	MHB-382SD	AH.50215	8-19-2016
				8-17-2017
Thermometer (SAR3)	Lutron	MHB-382SD	AH.50213	8-24-2016
				8-17-2017

Others

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Base Station Simulator	R & S	CMW500	150313	8-18-2016
				8-16-2017
Base Station Simulator	R & S	CMW500	150314	8-18-2016
				8-16-2017

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.

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6. Device Under Test (DUT) Information

6.1. DUT Description

Device Dimension	Overall (Length x Width): 121.8 mm x 63.5 mm Overall Diagonal: 129.4 mm Display Diagonal: 101.6 mm		
Back Cover	☒ Normal Battery Cover ☐ Normal Battery Cover with NFC ☐ Wireless Charger Battery Cover ☐ Wireless Charger Battery Cover with NFC ☐ The rechargeable battery is not user accessible.		
Battery Options	☒ Standard – Lithium-ion battery, Rating 3.8Vdc, 5.7Wh ☐ Extended (large capacity) ☐ The rechargeable battery is not user accessible.		
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)		
Wi-Fi Direct	Wi-Fi Direct enabled devices transfer data directly between each other ☒ Wi-Fi Direct (Wi-Fi 2.4 GHz)		
Test Sample Information	**No.**	**S/N**	**Notes**
	1	R31GB00CB6Y	Conducted, SAR
	2	R31GB00ETXT	Conducted
	3	R31GB00EVFN	SAR
	4	R31H80007AM	Conducted (SM-J106H/DS)
	5	R31H800078J	Conducted, SAR (SM-J106H/DS)
	6	R31H800087R	Conducted, SAR (SM-J106H/DS)

6.2. Wireless Technologies

Wireless technologies	Frequency bands	Operating mode		Duty Cycle used for SAR testing
GSM	850 1900	Voice (GMSK) GPRS (GMSK) EGPRS (Rx only)	GPRS Multi-Slot Class: ☐ Class 8 - 1 Up, 4 Down ☐ Class 10 - 2 Up, 4 Down ☒ Class 12 - 4 Up, 4 Down ☐ Class 33 - 4 Up, 5 Down	GSM Voice: 12.5% (E)GPRS: 1 Slot: 12.5% 2 Slots: 25% 3 Slots: 37.5% 4 Slots: 50%
	Does this device support DTM (Dual Transfer Mode)? ☐ Yes ☒ No			
Wi-Fi	2.4 GHz	802.11b 802.11g 802.11n (HT20)		100%
Bluetooth	2.4 GHz	Version 4.1 LE		N/A

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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		Max. RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit
GSM850	Voice (1 slot)	32.0	**32.5**
	GPRS 1 slot	32.0	**32.5**
	GPRS 2 slots	30.8	**31.3**
	GPRS 3 slots	29.5	**30.0**
	GPRS 4 slots	27.5	**28.0**
GSM1900	Voice (1 slot)	29.2	**29.7**
	GPRS 1 slot	29.2	**29.7**
	GPRS 2 slots	27.5	**28.0**
	GPRS 3 slots	26.4	**26.9**
	GPRS 4 slots	24.4	**24.9**

Upper limit (dB): 0.5		Max. RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit
WiFi 2.4 GHz	802.11b	16.0	**16.5**
	802.11g	13.0	**13.5**
	802.11n HT20	13.0	**13.5**
Bluetooth		8.5	**9.0**
Bluetooth LE		0.5	**1.0**

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7. RF Exposure Conditions (Test Configurations)

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

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

Notes:

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

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8. Dielectric Property Measurements & System Check

8.1. Dielectric Property Measurements

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

Tissue Dielectric Parameters

FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

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

IEEE Std 1528-2013

Refer to Table 3 within the IEEE Std 1528-2013

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Dielectric Property Measurements Results:

SAR 1 Room

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
12-17-2015	Head 2450	e'	38.08	Relative Permittivity (εr):	38.08	39.20	-2.86	5
		e"	13.72	Conductivity (σ):	1.87	1.80	3.84	5
	Head 2410	e'	38.21	Relative Permittivity (εr):	38.21	39.28	-2.72	5
		e"	13.62	Conductivity (σ):	1.83	1.76	3.67	5
	Head 2475	e'	37.98	Relative Permittivity (εr):	37.98	39.17	-3.03	5
		e"	13.79	Conductivity (σ):	1.90	1.83	3.87	5
12-17-2015	Body 2450	e'	52.8200	Relative Permittivity (εr):	52.82	52.70	0.23	5
		e"	14.7600	Conductivity (σ):	2.01	1.95	3.11	5
	Body 2410	e'	52.9300	Relative Permittivity (εr):	52.93	52.76	0.32	5
		e"	14.6600	Conductivity (σ):	1.96	1.91	2.99	5
	Body 2475	e'	52.7600	Relative Permittivity (εr):	52.76	52.67	0.17	5
		e"	14.8300	Conductivity (σ):	2.04	1.99	2.81	5

SAR 2 Room

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
12-15-2015	Body 835	e'	54.2300	Relative Permittivity (εr):	54.23	55.20	-1.76	5
		e"	21.6900	Conductivity (σ):	1.01	0.97	3.82	5
	Body 820	e'	54.3600	Relative Permittivity (εr):	54.36	55.28	-1.66	5
		e"	21.7900	Conductivity (σ):	0.99	0.97	2.59	5
	Body 850	e'	54.0800	Relative Permittivity (εr):	54.08	55.16	-1.95	5
		e"	21.5900	Conductivity (σ):	1.02	0.99	3.37	5
12-16-2015	Head 835	e'	40.3400	Relative Permittivity (εr):	40.34	41.50	-2.80	5
		e"	19.4000	Conductivity (σ):	0.90	0.90	0.08	5
	Head 820	e'	40.5100	Relative Permittivity (εr):	40.51	41.60	-2.63	5
		e"	19.4200	Conductivity (σ):	0.89	0.90	-1.45	5
	Head 850	e'	40.1800	Relative Permittivity (εr):	40.18	41.50	-3.18	5
		e"	19.4000	Conductivity (σ):	0.92	0.92	0.21	5
12-21-2015	Body 2450	e'	50.4600	Relative Permittivity (εr):	50.46	52.70	-4.25	5
		e"	13.8300	Conductivity (σ):	1.88	1.95	-3.38	5
	Body 2410	e'	50.6600	Relative Permittivity (εr):	50.66	52.76	-3.98	5
		e"	13.6800	Conductivity (σ):	1.83	1.91	-3.90	5
	Body 2475	e'	50.3700	Relative Permittivity (εr):	50.37	52.67	-4.36	5
		e"	13.9400	Conductivity (σ):	1.92	1.99	-3.36	5
8-30-2016	Head 2450	e'	40.5700	Relative Permittivity (εr):	40.57	39.20	3.49	5
		e"	13.7500	Conductivity (σ):	1.87	1.80	4.06	5
	Head 2410	e'	40.7200	Relative Permittivity (εr):	40.72	39.28	3.67	5
		e"	13.6300	Conductivity (σ):	1.83	1.76	3.75	5
	Head 2475	e'	40.4700	Relative Permittivity (εr):	40.47	39.17	3.32	5
		e"	13.8300	Conductivity (σ):	1.90	1.83	4.17	5

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SAR 3 Room

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
12-14-2015	Body 1900	e'	52.1400	Relative Permittivity (εr):	52.14	53.30	-2.18	5
		e"	14.9100	Conductivity (σ):	1.58	1.52	3.63	5
	Body 1850	e'	52.3500	Relative Permittivity (εr):	52.35	53.30	-1.78	5
		e"	14.8300	Conductivity (σ):	1.53	1.52	0.36	5
	Body 1910	e'	52.0900	Relative Permittivity (εr):	52.09	53.30	-2.27	5
		e"	14.9400	Conductivity (σ):	1.59	1.52	4.39	5
12-17-2015	Head 1900	e'	38.0900	Relative Permittivity (εr):	38.09	40.00	-4.77	5
		e"	13.7800	Conductivity (σ):	1.46	1.40	3.99	5
	Head 1850	e'	38.2600	Relative Permittivity (εr):	38.26	40.00	-4.35	5
		e"	13.6600	Conductivity (σ):	1.41	1.40	0.37	5
	Head 1910	e'	38.0500	Relative Permittivity (εr):	38.05	40.00	-4.88	5
		e"	13.8100	Conductivity (σ):	1.47	1.40	4.76	5
9-5-2016	Body 835	e'	53.7600	Relative Permittivity (εr):	53.76	55.20	-2.61	5
		e"	21.5300	Conductivity (σ):	1.00	0.97	3.05	5
	Body 820	e'	53.9100	Relative Permittivity (εr):	53.91	55.28	-2.47	5
		e"	21.6000	Conductivity (σ):	0.98	0.97	1.69	5
	Body 850	e'	53.6100	Relative Permittivity (εr):	53.61	55.16	-2.80	5
		e"	21.4600	Conductivity (σ):	1.01	0.99	2.75	5
9-8-2016	Head 1900	e'	38.3700	Relative Permittivity (εr):	38.37	40.00	-4.08	5
		e"	13.7500	Conductivity (σ):	1.45	1.40	3.76	5
	Head 1850	e'	38.5600	Relative Permittivity (εr):	38.56	40.00	-3.60	5
		e"	13.6300	Conductivity (σ):	1.40	1.40	0.15	5
	Head 1910	e'	38.3300	Relative Permittivity (εr):	38.33	40.00	-4.18	5
		e"	13.7800	Conductivity (σ):	1.46	1.40	4.53	5

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8.2. System Check

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

System Performance Check Measurement Conditions:

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

Reference Target SAR Values

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

System Dipole	Serial No.	Cal. Date	Freq. (MHz)	Target SAR Values (W/kg)		
				1g/10g	Head	Body
D835V2	4d194	9-17-2015	835	1g	9.38	9.49
				10g	6.09	6.18
D835V2	4d174	9-30-2015	835	1g	9.23	9.49
				10g	6.01	6.22
D1900V2	5d199	2-6-2015	1900	1g	41.00	40.60
				10g	21.40	21.60
D2450V2	960	2-5-2015	2450	1g	53.30	50.80
				10g	24.80	23.60
D2450V2	939	9-28-2015	2450	1g	51.60	50.70
				10g	23.90	23.70

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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 1 Room

Date Tested	System Dipole		T.S. Liquid		Measured Results		Target (Ref. Value)	Delta ±10 %	Plot No.
	Type	Serial #			Zoom Scan to 100 mW	Normalize to 1 W			
12-17-2015	D2450V2	960	Head	1g	5.39	53.90	53.30	1.13	
				10g	2.46	24.60	24.80	-0.81	
12-17-2015	D2450V2	960	Body	1g	4.93	49.30	50.80	-2.95	1,2
				10g	2.27	22.70	23.60	-3.81	

SAR 2 Room

Date Tested	System Dipole		T.S. Liquid		Measured Results		Target (Ref. Value)	Delta ±10 %	Plot No.
	Type	Serial #			Zoom Scan to 100 mW	Normalize to 1 W			
12-15-2015	D835V2	4d194	Body	1g	1.02	10.20	9.49	7.48	
				10g	0.67	6.70	6.18	8.41	
12-16-2015	D835V2	4d194	Head	1g	1.01	10.10	9.38	7.68	3,4
				10g	0.67	6.69	6.09	9.85	
12-21-2015	D2450V2	960	Body	1g	5.29	52.90	50.8	4.13	5,6
				10g	2.44	24.40	23.60	3.39	
8-30-2016	D2450V2	939	Head	1g	5.33	53.30	51.60	3.29	
				10g	2.39	23.90	23.90	0.00	

SAR 3 Room

Date Tested	System Dipole		T.S. Liquid		Measured Results		Target (Ref. Value)	Delta ±10 %	Plot No.
	Type	Serial #			Zoom Scan to 100 mW	Normalize to 1 W			
12-14-2015	D1900V2	5d199	Body	1g	4.10	41.00	40.6	0.99	7,8
				10g	2.06	20.60	21.6	-4.63	
12-17-2015	D1900V2	5d199	Head	1g	4.04	40.40	41	-1.46	9,10
				10g	2.06	20.60	21.4	-3.74	
9-5-2016	D835V2	4d174	Body	1g	1.03	10.30	9.49	8.54	11,12
				10g	0.68	6.75	6.22	8.52	
9-8-2016	D1900V2	5d199	Head	1g	4.01	40.10	39.80	0.75	
				10g	2.06	20.60	20.70	-0.48	

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9. Conducted Output Power Measurements

9.1. GSM

Per KDB 941225 D01 3G SAR Procedures:

SAR test reduction for GPRS and EDGE modes is determined by the source-based time-averaged output power specified for production units, including tune-up tolerance. The data mode with highest specified time-averaged output power should be tested for SAR compliance in the applicable exposure conditions. For modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested.

GSM850 Measured Results

Band	Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Max. Pwr	
						Burst (dBm)	Frame (dBm)
850	GSM (Voice)	CS1	1	128	824.2	32.1	23.0
				190	836.6	32.2	23.1
				251	848.8	32.2	23.2
	GPRS (GMSK)	CS1	1	128	824.2	32.1	23.1
				190	836.6	32.2	23.1
				251	848.8	32.2	23.2
			2	128	824.2	30.3	24.3
				190	836.6	30.4	24.3
				251	848.8	30.4	24.4
			3	128	824.2	29.0	24.8
				190	836.6	29.1	24.8
				251	848.8	29.2	24.9
			4	128	824.2	27.0	23.9
				190	836.6	27.1	24.0
				251	848.8	27.1	24.1

EGPRS(8PSK) is Rx only

Notes:

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

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

GSM1900 Measured Results

Band	Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Max. Pwr	
						Burst (dBm)	Frame (dBm)
1900	GSM (Voice)	CS1	1	512	1850.2	29.4	20.3
				661	1880.0	29.6	20.6
				810	1909.8	29.4	20.4
	GPRS (GMSK)	CS1	1	512	1850.2	29.4	20.3
				661	1880.0	29.6	20.6
				810	1909.8	29.4	20.4
			2	512	1850.2	27.4	21.4
				661	1880.0	27.6	21.6
				810	1909.8	27.5	21.5
			3	512	1850.2	26.3	22.1
				661	1880.0	26.5	22.2
				810	1909.8	26.4	22.2
			4	512	1850.2	24.3	21.3
				661	1880.0	24.4	21.4
				810	1909.8	24.4	21.4

EGPRS(8PSK) is Rx only

Notes:

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

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

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9.2. Wi-Fi 2.4GHz (DTS Band)

Measured Results

Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	Avg Pwr (dBm)	Max Output Power (dBm)	SAR Test (Yes/No)	Note(s)
2.4	802.11b	1 Mbps	1	2412	15.9	16.5	Yes	
			6	2437	15.7			
			11	2462	16.2			
	802.11g	6 Mbps	1	2412	Not Require	13.5	No	1
			6	2437				
			11	2462				
	802.11n (HT20)	6.5 Mbps	1	2412	Not Require	13.5	No	1
			6	2437				
			11	2462				

Note(s):

1. Output Power and SAR is not required for 802.11g/n HT20 channels when the highest *reported* SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.

9.3. Bluetooth

Maximum tune-up tolerance limit is 9 dBm from the rated nominal maximum output power. This power level qualifies for exclusion of SAR testing.

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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 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.

Additional 1-g SAR testing at 5 mm is not required. For hotspot mode, 10-g extremity SAR is not required for the surfaces and edges since all 1-g reported SAR < 1.2 W/kg. **(for Phablet only)**

KDB 941225 D01 SAR test for 3G devices:
When the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤ ¼ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode

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KDB 248227 D01 SAR meas for 802.11:

SAR test reduction for 802.11 Wi-Fi transmission mode configurations are considered separately for DSSS and OFDM. An initial test position is determined to reduce the number of tests required for certain exposure configurations with multiple test positions. An initial test configuration is determined for each frequency band and aggregated band according to maximum output power, channel bandwidth, wireless mode configurations and other operating parameters to streamline the measurement requirements. For 2.4 GHz DSSS, either the initial test position or DSSS procedure is applied to reduce the number of SAR tests; these are mutually exclusive. For OFDM, an initial test position is only applicable to next to the ear, UMPC mini-tablet and hotspot mode configurations, which is tested using the initial test configuration to facilitate test reduction. For other exposure conditions with a fixed test position, SAR test reduction is determined using only the initial test configuration.

The multiple test positions require SAR measurements in head, hotspot mode or UMPC mini-tablet configurations may be reduced according to the highest reported SAR determined using the *initial test position(s)* by applying the DSSS or OFDM SAR measurement procedures in the required wireless mode test configuration(s). The *initial test position(s)* is measured using the highest measured maximum output power channel in the required wireless mode test configuration(s). When the *reported* SAR for the *initial test position* is:

- ≤ 0.4 W/kg, further SAR measurement is not required for the other test positions in that exposure configuration and wireless mode combination within the frequency band or aggregated band. DSSS and OFDM configurations are considered separately according to the required SAR procedures.
- > 0.4 W/kg, SAR is repeated using the same wireless mode test configuration tested in the *initial test position* to measure the subsequent next closet/smallest test separation distance and maximum coupling test position, on the highest maximum output power channel, until the *reported* SAR is ≤ 0.8 W/kg or all required test positions are tested.
  - For subsequent test positions with equivalent test separation distance or when exposure is dominated by coupling conditions, the position for maximum coupling condition should be tested.
  - When it is unclear, all equivalent conditions must be tested.
- For all positions/configurations tested using the *initial test position* and subsequent test positions, when the *reported* SAR is > 0.8 W/kg, measure the SAR for these positions/configurations on the subsequent next highest measured output power channel(s) until the *reported* SAR is ≤ 1.2 W/kg or all required test channels are considered.
  - The additional power measurements required for this step should be limited to those necessary for identifying subsequent highest output power channels to apply the test reduction.
- When the specified maximum output power is the same for both UNII 1 and UNII 2A, begin SAR measurements in UNII 2A with the channel with the highest measured output power. If the reported SAR for UNII 2A is ≤ 1.2 W/kg, SAR is not required for UNII 1; otherwise treat the remaining bands separately and test them independently for SAR.
- When the specified maximum output power is different between UNII 1 and UNII 2A, begin SAR with the band that has the higher specified maximum output. If the highest reported SAR for the band with the highest specified power is ≤ 1.2 W/kg, testing for the band with the lower specified output power is not required; otherwise test the remaining bands independently for SAR.

To determine the *initial test position*, Area Scans were performed to determine the position with the *Maximum Value of SAR (measured)*. The position that produced the highest *Maximum Value of SAR* is considered the worst case position; thus used as the *initial test position*.

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10.1. GSM850

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Voice	0	Left Touch	190	836.6	32.5	32.2	0.280	0.303	
			Left Tilt	190	836.6	32.5	32.2	0.166	0.180	
			Right Touch	190	836.6	32.5	32.2	0.340	0.368	
			Right Tilt	190	836.6	32.5	32.2	0.189	0.204	
Head VoIP	GPRS 3 Slots	0	Left Touch	190	836.6	30.0	29.1	0.408	0.501	
			Left Tilt	190	836.6	30.0	29.1	0.250	0.307	
			Right Touch	190	836.6	30.0	29.1	0.517	0.635	1
			Right Tilt	190	836.6	30.0	29.1	0.280	0.344	
Body-worn	Voice	10	Rear	190	836.6	32.5	32.2	0.488	0.528	
			Front	190	836.6	32.5	32.2	0.438	0.474	
Body-worn(VoIP) & Hotspot	GPRS 3 Slots	10	Rear	128	824.2	30.0	29.0	0.710	0.890	
				190	836.6	30.0	29.1	0.733	0.900	
				251	848.8	30.0	29.2	0.763	0.919	2
			Front	190	836.6	30.0	29.1	0.645	0.792	
Hotspot			Edge 2	190	836.6	30.0	29.1	0.518	0.636	
			Edge 3	190	836.6	30.0	29.1	0.071	0.087	
			Edge 4	190	836.6	30.0	29.1	0.390	0.479	

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	29.6	0.358	0.366	
			Left Tilt	661	1880.0	29.7	29.6	0.245	0.250	
			Right Touch	661	1880.0	29.7	29.6	0.636	0.650	
			Right Tilt	661	1880.0	29.7	29.6	0.219	0.224	
Head VoIP	GPRS 3 Slots	0	Left Touch	661	1880.0	26.9	26.5	0.500	0.554	
			Left Tilt	661	1880.0	26.9	26.5	0.345	0.382	
			Right Touch	512	1850.2	26.9	26.3	0.822	0.933	
				661	1880.0	26.9	26.5	0.887	0.982	
				810	1909.8	26.9	26.4	0.972	1.087	3
			Right Tilt	661	1880.0	26.9	26.5	0.306	0.339	
Body-worn	Voice	10	Rear	661	1880.0	29.7	29.6	0.564	0.577	
			Front	661	1880.0	29.7	29.6	0.505	0.516	
Body-worn(VoIP) & Hotspot	GPRS 3 Slots	10	Rear	512	1850.2	26.9	26.3	0.762	0.865	
				661	1880.0	26.9	26.5	0.791	0.876	
				810	1909.8	26.9	26.4	0.806	0.901	4
			Front	661	1880.0	26.9	26.5	0.703	0.778	
Hotspot			Edge 2	661	1880.0	26.9	26.5	0.346	0.383	
			Edge 3	661	1880.0	26.9	26.5	0.317	0.351	
			Edge 4	661	1880.0	26.9	26.5	0.062	0.068	

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10.3. Wi-Fi (DTS Band)

Frequency Band	Mode	RF Exposure Conditions	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Power (dBm)		1-g SAR (W/kg)		Plot No.
								Tune-up limit	Meas.	Meas.	Scaled	
2.4GHz	802.11b 1 Mbps	Head	0	Left Touch	11	2462	1.013	16.5	16.2	0.729	0.781	5
				Left Tilt	11	2462	0.637	16.5	16.2	0.435	0.466	
				Right Touch	11	2462	0.434	16.5	16.2	0.387	0.415	
				Rightt Tilt	11	2462	0.299	16.5	16.2			
		Body-worn & Hotspot & Wi-Fi Direct	10	Rear	11	2462	0.109	16.5	16.2			
				Front	11	2462	0.149	16.5	16.2	0.100	0.107	6
				Edge 1	11	2462	0.100	16.5	16.2			
				Edge 2	11	2462	0.138	16.5	16.2			

Note(s):

1. Highest *reported* SAR is ≤ 0.4 W/kg. Therefore, further SAR measurements within this exposure condition are not required.
2. Highest *reported* SAR is > 0.4 W/kg. Due to the highest *reported* SAR for this test position, other test positions in Head exposure condition were evaluated until a SAR ≤ 0.8 W/kg was *reported*.
3. Testing for a second channel was required because the *reported* SAR for this test position was >0.8 W/kg.
4. Additional testing required in order satisfying FCC simultaneous transmission limit criteria.

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10.4. Bluetooth

Standalone SAR Test Exclusion Considerations & Estimated SAR

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

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

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

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

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

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

Body-worn Accessory Exposure Conditions

Max. tune-up tolerance limit		Min. test separation distance (mm)	Frequency (GHz)	SAR test exclusion Result*	Test Configuration	Estimated 1-g SAR (W/kg)
(dBm)	(mW)					
9.0	8	10	2.480	1.3	Rear/Front	0.168

Conclusion:

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

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11. SAR Measurement Variability

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

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

Frequency Band (MHz)	Air Interface	RF Exposure Conditions	Test Position	Repeated SAR (Yes/No)	Highest Measured SAR (W/kg)	Repeated Measured SAR (W/kg)	Largest to Smallest SAR Ratio
850	GSM850	Body & Hotspot	Rear	No	0.763	N/A	N/A
1900	GSM 1900	Head	Right Touch	Yes	0.972	0.962	1.01
2400	Wi-Fi 802.11b/g/n	Head	Left Touch	No	0.729	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.

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12. Simultaneous Transmission SAR Analysis

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

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

Where:

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

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

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

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

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

Simultaneous Transmission Condition

RF Exposure Condition	Item	Capable Transmit Configurations		
Head	1	GSM(Voice)	+	DTS
	2	GSM(GPRS)	+	DTS
Body-worn	3	GSM(Voice)	+	DTS
	4	GSM(Voice)	+	BT
	5	GSM(GPRS)	+	DTS
	6	GSM(GPRS)	+	BT
Hotspot & Wi-Fi Direct	7	GSM(GPRS)	+	DTS

Notes:
1. DTS support Hotspot and Wi-Fi Direct.
2. GPRS support Hotspot.
3. VoIP is supported in GPRS
4. DTS Radio cannot transmit simultaneously with Bluetooth Radio.

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

RF Exposure conditions	Test Position	① WWAN	② DTS	③ BT	① + ② WWAN + DTS		① + ③ WWAN + BT	
					∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)	∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)
Head	Left Touch	0.501	0.781		1.282	No		
	Left Tilt	0.307	0.466		0.773	No		
	Right Touch	0.635	0.415		1.050	No		
	Right Tilt	0.344	0.781		1.125	No		
Body -worn & Hotspot	All position	0.919	0.107	0.168	1.026	No	1.087	No

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

RF Exposure conditions	Test Position	① WWAN	② DTS	③ BT	① + ② WWAN + DTS		① + ③ WWAN + BT	
					∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)	∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)
Head	Left Touch	0.554	0.781		1.335	No		
	Left Tilt	0.382	0.466		0.848	No		
	Right Touch	1.087	0.415		1.502	No		
	Right Tilt	0.339	0.781		1.120	No		
Body -worn & Hotspot	All position	0.901	0.107	0.168	1.008	No	1.069	No

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.

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Appendixes

Refer to separated files for the following appendixes.

16K23808-S1V2 FCC Report SAR_App A_Photos & Ant. Locations

16K23808-S1V2 FCC Report SAR_App B_Highest SAR Test Plots

16K23808-S1V2 FCC Report SAR_App C_System Check Plots

16K23808-S1V2 FCC Report SAR_App D_SAR Tissue Ingredients

16K23808-S1V2 FCC Report SAR_App E_Probe Cal. Certificates

16K23808-S1V2 FCC Report SAR_App F_Dipole Cal. Certificates

END OF REPORT

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