



**FCC 47 CFR Parts 1 & 2
Published RF Exposure KDB Procedures
IEEE Std 1528-2013**

SAR EVALUATION REPORT

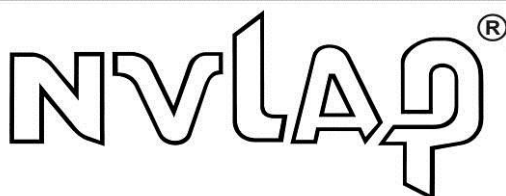
For
GSM/WCDMA Phone + Bluetooth & WLAN 2.4GHz b/g/n

**Model: SM-G3812B
FCC ID: A3LSMG3812B**

**Report Number: 13I16708-5B
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--	1/9/2014	Initial Issue	--
A	1/13/2014	1. Section 4.1.: Corrected Measuring Instrument Calibration typo. 2. Section 7.3.: Updated tune-up limit for GSM850 4 time slot. 3. Section 9.2.: Updated W-CDMA Band V HSDPA output power. 4. Section 9.1.: Corrected GSM1900 note.	Devin Chang
B	1/14/2014	1. Section 7.3.: Updated W-CDMA Band V output power tune-up tolerance.	Devin Chang

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1. Attestation of Test Results

Applicant	Samsung Electronics Co., Ltd.			
DUT description	GSM/WCDMA Phone + Bluetooth & WLAN 2.4GHz b/g/n			
Model	SM-G3812B			
Test device is	An identical prototype			
Device category	Portable			
Exposure category	General Population/Uncontrolled Exposure			
Date tested	12/26/2013 – 12/30/2013			
The highest reported SAR values	RF exposure condition	Licensed	DTS	UNII
	Head	0.428 W/kg	0.309 W/kg	N/A
	Body-worn Accessory	0.756 W/kg	0.074 W/kg	N/A
	Wireless Router (Hotspot)	1.056 W/kg	0.074 W/kg	N/A
	Simultaneous Transmission	1.130 W/kg		
Applicable Standards	FCC 47 CFR Parts 1 & 2 Published RF Exposure KDB Procedures, and TCB workshop updates IEEE Std 1528-2013			
Test Results	Pass			

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

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

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2. Test Methodology

The tests documented in this report were performed in accordance with FCC 47 CFR Parts 1 & 2, IEEE STD 1528-2013, the following FCC Published RF exposure KDB procedures, and TCB workshop updates:

- 447498 D01 General RF Exposure Guidance v05r01
- 648474 D04 Handset SAR v01r01
- 941225 D01 SAR test for 3G devices v02
- 941225 D02 HSPA and 1x Advanced v02r02
- 941225 D03 SAR Test Reduction GSM GPRS EDGE v01
- 941225 D04 SAR for GSM E GPRS Dual Xfer Mode v01
- 941225 D06 Hot Spot SAR v01r01
- 248227 D01 SAR Meas for 802 11abg v01r02
- 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r01
- 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 & 47266 Benicia Street, Fremont, California, USA.

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 F	

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://www.ccsemc.com>.

4. Calibration and Uncertainty

4.1. Measuring Instrument Calibration

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.

Tissue Dielectric Properties

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Network Analyzer	Agilent	8753ES	MY40000980	2/20/2014
Dielectronic Probe kit	SPEAG	DAK-3.5	1082	9/10/2014
Dielectronic Probe kit	SPEAG	DAK-3.5 Short	SM DAK 200 BA	N/A
Thermometer	Control Company	4242	122529162	9/19/2014

System Performance Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Synthesized Signal Generator	HP	8665B	3546A00784	3/26/2014
Power Meter	Agilent	N1912A	MY50001018	8/23/2014
Power Sensor	Agilent	E9323A	MY53070009	4/3/2014
Power Sensor	Agilent	E9323A	USF40411556	8/9/2014
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1795093	N/A
Directional coupler	Werlatone	C8060-102	2711	N/A
DC Power Supply	Ametek	XT 20-3	1318A00529	N/A
E-Field Probe (Lab A)	SPEAG	EX3DV4	3749	1/15/2014
Data Acquisition Electronics (Lab A)	SPEAG	DAE4	1239	4/9/2014
E-Field Probe (Lab B)	SPEAG	EX3DV4	3772	2/20/2014
Data Acquisition Electronics (Lab B)	SPEAG	DAE4	427	1/9/2014
E-Field Probe (Lab D)	SPEAG	EX3DV4	3686	3/11/2014
Data Acquisition Electronics (Lab D)	SPEAG	DAE4	1360	2/7/2014
System Validation Dipole	SPEAG	D835V2	4d002	11/15/2014
System Validation Dipole	SPEAG	D1900V2	5d043	11/12/2014
System Validation Dipole	SPEAG	D2450V2	899	9/10/2014

Others

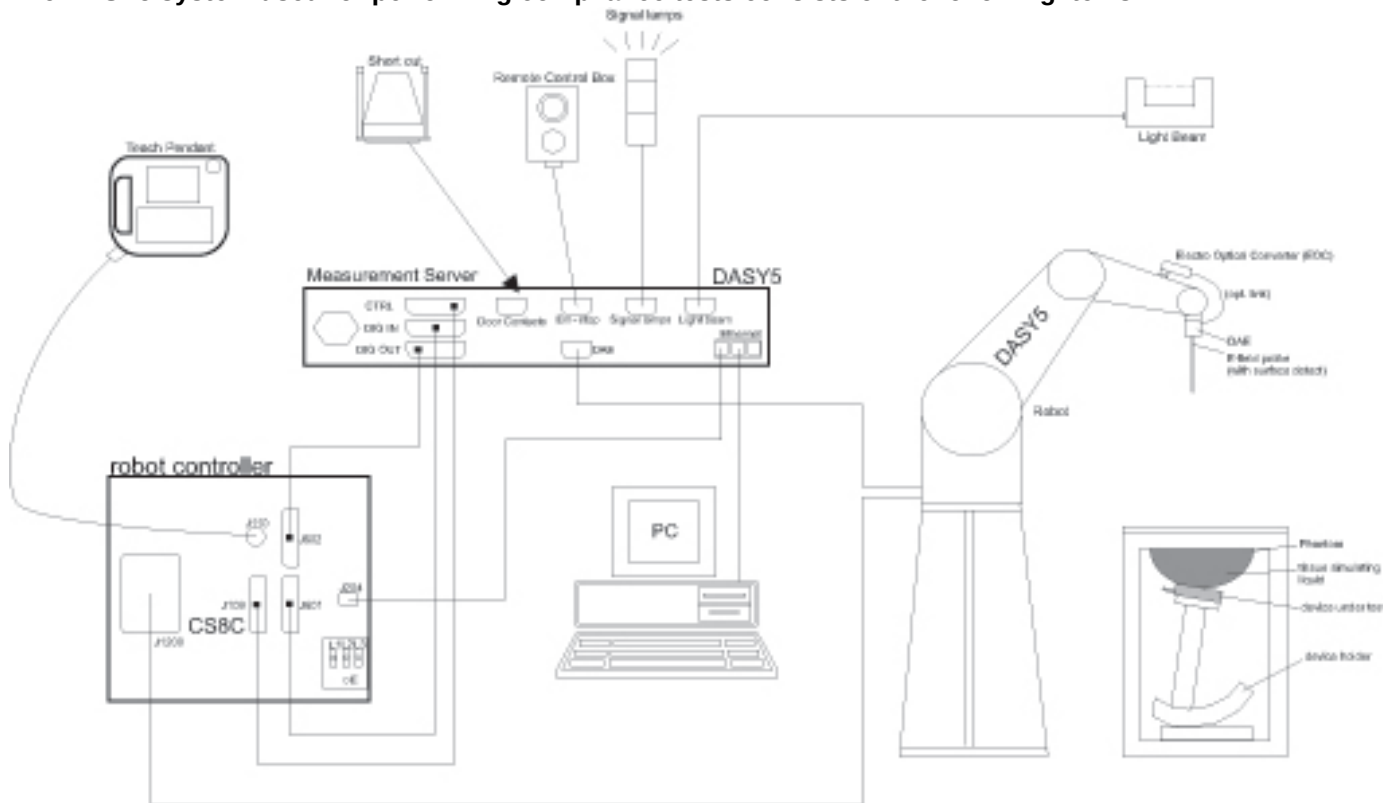
Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Power Meter	Agilent	N1912A	MY52310061	12/12/2014
Power Sensor	Agilent	N1921A	MY52020012	9/25/2014
Base Station Simulator	R & S	CMW500	132909	2/20/2014

4.2. Measurement Uncertainty

Per KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r01 Section 2.8.1., 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.

5. Measurement System Description and Setup

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.

6. SAR Measurement Procedure

6.1. Normal SAR Measurement 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 v01r01

	≤ 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 v01r01

			≤ 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 <u>reported</u> 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.

6.2. Volume Scan Procedures

Step 1: Repeat Step 1-4 in Section 6.1

Step 2: Volume Scan

Volume Scans are used to assess peak SAR and averaged SAR measurements in largely extended 3-dimensional volumes within any phantom. This measurement does not need any previous area scan. The grid can be anchored to a user specific point or to the current probe location.

Step 3: 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.

7. Device Under Test

7.1. General Information

Operating Configuration(s)	Held to head, Body-worn (Voice call)
Mobile 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)
Device dimensions	Overall (Length x Width): 133 mm x 66 mm Overall Diagonal: 139 mm Display Diagonal: 115 mm
Back Cover	☒ Normal Battery Cover ☐ Wireless Charger Battery Cover ☐ Normal Battery Cover with NFC
Accessory	☒ Headset
Battery Options	☒ Standard – Lithium-ion battery, Rating 3.8 Vdc, 7.98 Wh ☐ Extended (large capacity)

7.2. Wireless Technologies

Wireless Technology and Frequency Bands	GSM: 850/1900 W-CDMA Band: V Wi-Fi: 2.4 GHz Bluetooth: 2.4 GHz.
Mode	GSM - ☒ Voice (GMSK) - ☒ GPRS (GMSK) - ☐ EGPRS (8PSK) W-CDMA - ☒ UMTS Rel. 99 - ☒ HSDPA (Rel. 5) - ☒ HSUPA (Rel. 6) - ☐ DC-HSDPA (Rel.) - ☐ HSPA+ (Rel.) Wi-Fi 2.4GHz (802.11b/g/n) - ☒ 802.11b - ☒ 802.11g - ☒ 802.11n (20MHz) - ☐ 802.11n (40MHz) Bluetooth Ver. 4.0 (LE)
Duty Cycle (used for SAR testing)	GSM Voice: 12.5%; GPRS 1 Slot: 12.5%; 2 Slots: 25%, 3 Slots: 37.5%, 4 Slots: 50%, W-CDMA: 100% Wi-Fi 802.11b/g/n: 100%
GPRS Multi-Slot Class	☐ Class 8 - One Up ☐ Class 10 - Two Up ☒ Class 12 - Four Up
DTM (Dual Transfer Mode)	☐ Supported
VoIP (GPRS)	☒ Supported
SV-LTE & SV-DO	☐ Supported

7.3. Output Power Tune-up Tolerance

Upper limit (dB): 0.5 ~ -1.5		RF Output Power (dBm)									
		Target					Max. tune-up tolerance limit				
RF Air interface	Mode	1 Slot	2 Slot	3 Slot	4 Slot	1 Slot	2 Slot	3 Slot	4 Slot		
GSM850	Voice	32.5				33.0					
	GPRS	32.5	31.0	29.0	27.0	33.0	31.5	29.5	27.5		
GSM1900	Voice	30.0				30.5					
	GPRS	30.0	28.5	26.5	25.0	30.5	29.0	27.0	25.5		
Upper limit (dB): 0.5		RF Output Power (dBm)									
		Target					Max. tune-up tolerance limit				
RF Air interface	Mode	Subtest 1	Subtest 2	Subtest 3	Subtest 4	Subtest 5	Subtest 1	Subtest 2	Subtest 3	Subtest 4	Subtest 5
W-CDMA Band V	R99	22.5					23.0				
	HSDPA	22.5	21.0	19.5	19.5		23.0	21.5	20.0	20.0	
	HSUPA	22.0	20.0	20.5	20.0	22.0	22.5	20.5	21.0	20.5	22.5
Upper limit (dB): 0.5 ~ -1.5		RF Output Power (dBm)									
		Target					Max. tune-up tolerance limit				
RF Air interface	Mode										
Wi-Fi 2.4 GHz	802.11b	14.0					14.5				
	802.11g	12.0					12.5				
	802.11n (HT20)	12.0					12.5				
Upper limit (dB): 0.5 ~ -1.5		RF Output Power (dBm)									
		Target					Max. tune-up tolerance limit				
RF Air interface											
Bluetooth		9.0					9.5				
Bluetooth LE		9.0					9.5				

7.4. Simultaneous Transmission Condition

RF Exposure Condition	Capable Transmit Configurations
Head	- GSM 850/1900 Voice + Wi-Fi 2.4 - GSM 850/1900 (GPRS/EDGE) + Wi-Fi 2.4 (VoIP) - W-CDMA Band V + Wi-Fi 2.4
Body-worn Accessory	- GSM 850/1900 Voice + Wi-Fi 2.4 - GSM 850/1900 Voice + BT - GSM 850/1900 (GPRS/EDGE) + Wi-Fi 2.4 (VoIP) - GSM 850/1900 (GPRS/EDGE) + BT (VoIP) - W-CDMA Band V + Wi-Fi 2.4 - W-CDMA Band V + BT
Wireless Router (Hotspot) & Wi-Fi Direct	- GSM 850/1900 (GPRS/EDGE) + Wi-Fi 2.4 GHz - W-CDMA Band V + Wi-Fi 2.4 GHz
Notes: - Wi-Fi 2.4 GHz supports Hotspot. - Wi-Fi 2.4 GHz supports Wi-Fi Direct. - GPRS/EDGE and W-CDMA support Hotspot. 2.4 GHz WLAN and Bluetooth share the same antenna path and cannot transmit simultaneously.	

8. RF Exposure Conditions

Refer to Appendix "Antenna Locations and Separation Distances" for the specific details of the antenna-to-antenna and antenna-to-edge(s) distances.

8.1. Head Exposure Conditions

For WWAN and Wi-Fi

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

8.2. Body-worn Accessory & Hotspot Exposure Conditions

For WWAN

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	1 mm	Yes	
Front	7 mm	Yes	
Edge 1 (Top)	114 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 v01r01
Edge 2 (Right)	24 mm	Yes	
Edge 3 (Bottom)	2 mm	Yes	
Edge 4 (Left)	2 mm	Yes	

For Wi-Fi

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	1 mm	Yes	
Front	5 mm	Yes	
Edge 1 (Top)	2 mm	Yes	
Edge 2 (Right)	2 mm	Yes	
Edge 3 (Bottom)	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 v01r01
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 941225 D06 Hot Spot SAR v01r01

9. RF Output Power Measurement

9.1. GSM

GSM (GMSK) - Voice Mode

Band	Ch No.	Freq. (MHz)	Avg burst Pwr (dBm)
850	128	824.2	32.4
	190	836.6	32.8
	251	848.8	32.5

GPRS (GMSK) - Coding Scheme: CS1

Band	Ch No.	Freq. (MHz)	Avg Power (dBm)				Avg Power (dBm)			
			1 time slot		2 time slots		3 time slots		4 time slots	
			Burst	Frame	Burst	Frame	Burst	Frame	Burst	Frame
850	128	824.2	32.4	23.4	30.9	24.9	28.9	24.6	26.8	23.8
	190	836.6	32.8	23.8	31.3	25.3	29.4	25.1	27.3	24.3
	251	848.8	32.5	23.5	31.0	25.0	29.0	24.7	27.0	24.0

EGPRS (8PSK) - Coding Scheme: MCS5

This mode is Rx only

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

GSM (GMSK) - Voice Mode

Band	Ch No.	Freq. (MHz)	Avg burst Pwr (dBm)
1900	512	1850.2	30.0
	661	1880.0	30.0
	810	1909.8	29.6

GPRS (GMSK) - Coding Scheme: CS1

Band	Ch No.	Freq. (MHz)	Avg Power (dBm)				Avg Power (dBm)			
			1 time slot		2 time slots		3 time slots		4 time slots	
			Burst	Frame	Burst	Frame	Burst	Frame	Burst	Frame
1900	512	1850.2	30.0	21.0	27.5	21.5	26.1	21.8	24.0	21.0
	661	1880.0	30.0	21.0	27.6	21.6	26.2	21.9	24.1	21.1
	810	1909.8	29.6	20.6	27.4	21.4	26.0	21.7	23.8	20.8

EGPRS (8PSK) - Coding Scheme: MCS5

This mode is Rx only

Notes:

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

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

9.2. W-CDMA

Release 99

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
W-CDMA 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	22.4
		4183	836.6	22.4
		4233	846.6	22.5

HSDPA

The following 4 Sub-tests were completed according to Release 5 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	0	0.5	0.5
	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			

Measured Results

Band	Mode	UL Ch No.	Freq. (MHz)	Avg Pwr (dBm)
W-CDMA Band V	Subtest 1	4132	826.4	22.3
		4183	836.6	22.3
		4233	846.6	22.4
	Subtest 2	4132	826.4	20.9
		4183	836.6	21.0
		4233	846.6	20.9
	Subtest 3	4132	826.4	19.5
		4183	836.6	19.8
		4233	846.6	19.5
	Subtest 4	4132	826.4	19.6
		4183	836.6	19.5
		4233	846.6	19.5

Maximum output power levels that are possible for all subtests reported.

Note(s):

KDB 941225 D01 – Body SAR is not required for HSDPA when the maximum average output of each RF channel with HSDPA active is less than ¼ dB higher than that measured without HSDPA using 12.2 kbps RMC or the maximum SAR for 12.2 kbps RMC is < 75% of the SAR limit.

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
W-CDMA 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	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

Measured Results

Band	Mode	UL Ch No.	Freq. (MHz)	Avg Pwr (dBm)
W-CDMA Band V	Subtest 1	4132	826.4	21.8
		4183	836.6	21.8
		4233	846.6	22.2
	Subtest 2	4132	826.4	20.2
		4183	836.6	20.0
		4233	846.6	20.3
	Subtest 3	4132	826.4	20.6
		4183	836.6	20.6
		4233	846.6	20.7
	Subtest 4	4132	826.4	20.3
		4183	836.6	20.3
		4233	846.6	20.3
	Subtest 5	4132	826.4	21.8
		4183	836.6	21.9
		4233	846.6	21.9

Note(s):

KDB 941225 D01 – Body SAR is not required for handsets with HSPA capabilities when the maximum average output of each RF channel with HSUPA/HSDPA active is less than ¼ dB higher than that measured without HSUPA/HSDPA using 12.2 kbps RMC and the maximum SAR for 12.2kbps RMC is ≤ 75% of the SAR limit.

9.3. Wi-Fi (2.4 GHz Band)

Required Test Channels per KDB 248227 D01

Mode	Band	GHz	Channel	"Default Test Channels"	
				802.11b	802.11g
802.11b/g	2.4 GHz	2.412	1 [#]	√	▽
		2.437	6	√	▽
		2.462	11 [#]	√	▽

Notes:

√ = "default test channels"

▽ = possible 802.11g channels with maximum average output $\frac{1}{4}$ dB $\geq$ the "default test channels"

[#] = when output power is reduced for channel 1 and /or 11 to meet restricted band requirements the highest output channels closest to each of these channels should be tested.

Measured Results

Band (GHz)	Mode	Ch #	Freq. (MHz)	Avg Pwr (dBm)	SAR Test (Yes/No)
2.4 (DTS)	802.11b	1	2412	14.1	Yes
		6	2437	14.5	
		11	2462	14.3	
	802.11g	1	2412	12.1	No
		6	2437	12.5	
		11	2462	12.4	
	802.11n (HT20)	1	2412	12.1	No
		6	2437	12.5	
		11	2462	12.4	

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	14.5	Yes
			2 Mbps	14.3	No
			5.5 Mbps	13.3	No
			11 Mbps	13.8	No

Note(s):

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

9.4. Bluetooth

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

Refer to Standalone SAR Test Exclusion Considerations Section.

10. Tissue Dielectric Properties

IEEE Std 1528-2013

Target Frequency (MHz)	Head	
	ϵ_r	σ (S/m)
300	45.3	0.87
450	43.5	0.87
835	41.5	0.90
900	41.5	0.97
1450	40.5	1.20
1800 – 2000	40.0	1.40
2450	39.2	1.80
2600	39.0	1.96
3000	38.5	2.40

FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r01

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

10.1. Composition of Ingredients for the Tissue Material Used in the SAR Tests

The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

Ingredients (% by weight)	Frequency (MHz)									
	450		835		915		1900		2450	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	38.56	51.16	41.45	52.4	41.05	56.0	54.9	40.4	62.7	73.2
Salt (NaCl)	3.95	1.49	1.45	1.4	1.35	0.76	0.18	0.5	0.5	0.04
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	58.0	0.0	0.0
HEC	0.98	0.52	1.0	1.0	1.0	1.21	0.0	1.0	0.0	0.0
Bactericide	0.19	0.05	0.1	0.1	0.1	0.27	0.0	0.1	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8	0.0
DGBE	0.0	0.0	0.0	0.0	0.0	0.0	44.92	0.0	0.0	26.7
Dielectric Constant	43.42	58.0	42.54	56.1	42.0	56.8	39.9	54.0	39.8	52.5
Conductivity (S/m)	0.85	0.83	0.91	0.95	1.0	1.07	1.42	1.45	1.88	1.78

Salt: 99+% Pure Sodium Chloride

Sugar: 98+% Pure Sucrose

Water: De-ionized, 16 MΩ+ resistivity

HEC: Hydroxyethyl Cellulose

DGBE: 99+% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]

Triton X-100 (ultra pure): Polyethylene glycol mono [4-(1,1, 3, 3-tetramethylbutyl)phenyl]ether

Simulating Liquids for 5 GHz, Manufactured by SPEAG

Ingredients	(% by weight)
Water	78
Mineral oil	11
Emulsifiers	9
Additives and Salt	2

10.2. Tissue Dielectric Parameter Check 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 A

Tested date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
12/26/2013	Body 1900	e'	51.3800	Relative Permittivity (ϵ_r):	51.38	53.30	-3.60	5
		e"	14.5700	Conductivity (σ):	1.54	1.52	1.27	5
	Body 1850	e'	51.5400	Relative Permittivity (ϵ_r):	51.54	53.30	-3.30	5
		e"	14.5100	Conductivity (σ):	1.49	1.52	-1.80	5
	Body 1910	e'	51.3300	Relative Permittivity (ϵ_r):	51.33	53.30	-3.70	5
		e"	14.5800	Conductivity (σ):	1.55	1.52	1.87	5
12/26/2013	Head 1900	e'	40.5200	Relative Permittivity (ϵ_r):	40.52	40.00	1.30	5
		e"	13.2100	Conductivity (σ):	1.40	1.40	-0.32	5
	Head 1850	e'	40.7100	Relative Permittivity (ϵ_r):	40.71	40.00	1.78	5
		e"	13.0700	Conductivity (σ):	1.34	1.40	-3.97	5
	Head 1910	e'	40.4700	Relative Permittivity (ϵ_r):	40.47	40.00	1.18	5
		e"	13.2200	Conductivity (σ):	1.40	1.40	0.28	5
12/30/2013	Head 2450	e'	38.1200	Relative Permittivity (ϵ_r):	38.12	39.20	-2.76	5
		e"	13.0600	Conductivity (σ):	1.78	1.80	-1.16	5
	Head 2410	e'	38.2800	Relative Permittivity (ϵ_r):	38.28	39.28	-2.54	5
		e"	12.9600	Conductivity (σ):	1.74	1.76	-1.35	5
	Head 2475	e'	38.0300	Relative Permittivity (ϵ_r):	38.03	39.17	-2.91	5
		e"	13.1400	Conductivity (σ):	1.81	1.83	-1.03	5

SAR Lab B

Tested date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit $\pm$ (%)
12/30/2013	Body 2450	e'	51.6000	Relative Permittivity (ϵ_r):	51.60	52.70	-2.09	5
		e"	14.7700	Conductivity (σ):	2.01	1.95	3.18	5
	Body 2410	e'	51.7600	Relative Permittivity (ϵ_r):	51.76	52.76	-1.89	5
		e"	14.6000	Conductivity (σ):	1.96	1.91	2.57	5
	Body 2475	e'	51.5100	Relative Permittivity (ϵ_r):	51.51	52.67	-2.20	5
		e"	14.8700	Conductivity (σ):	2.05	1.99	3.08	5

SAR Lab D

Tested date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
12/26/2013	Head 835	e'	43.1600	Relative Permittivity (ϵ_r):	43.16	41.50	4.00	5
		e"	20.1500	Conductivity (σ):	0.94	0.90	3.95	5
	Head 820	e'	43.3300	Relative Permittivity (ϵ_r):	43.33	41.60	4.15	5
		e"	20.1800	Conductivity (σ):	0.92	0.90	2.41	5
	Head 850	e'	42.9400	Relative Permittivity (ϵ_r):	42.94	41.50	3.47	5
		e"	20.1100	Conductivity (σ):	0.95	0.92	3.87	5
12/26/2013	Body 835	e'	53.2500	Relative Permittivity (ϵ_r):	53.25	55.20	-3.53	5
		e"	21.3200	Conductivity (σ):	0.99	0.97	2.05	5
	Body 820	e'	53.3900	Relative Permittivity (ϵ_r):	53.39	55.28	-3.41	5
		e"	21.3200	Conductivity (σ):	0.97	0.97	0.37	5
	Body 850	e'	53.0900	Relative Permittivity (ϵ_r):	53.09	55.16	-3.75	5
		e"	21.2300	Conductivity (σ):	1.00	0.99	1.65	5

11. System Performance 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.

11.1. System Performance Check Measurement Conditions

- The measurements were performed in the flat section of the TWIN SAM or ELI phantom, shell thickness: 2.0 $\pm$ 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 $\pm$ 0.5 cm for SAR measurements ≤ 3 GHz and ≥ 10.0 cm $\pm$ 0.5 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.

11.2. Reference SAR Values for System Performance Check

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 (mW/g)		
				1g/10g	Head	Body
D835V2	4d002	11/15/2013	835	1g	9.49	9.43
				10g	6.18	6.21
D1900V2	5d043	11/12/2013	1900	1g	40.1	39
				10g	21.1	20.8
D24502	899	9/10/2013	2450	1g	51.3	49.7
				10g	23.9	23.3

11.3. System Performance Check Results

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

SAR Lab A

Date Tested	System Dipole		T.S. Liquid	Measured Results			Target (Ref. Value)	Delta ±10 %	Est./Zoom Ratio ±3 %	Plot No.	
	Type	Serial #		Area Scan	Zoom Scan	Normalize to 1 W					
12/26/2013	D1900V2	5d043	Body	1g	3.96	3.88	38.8	39	-0.51	2.02	1,2
				10g	2.01	1.97	19.7	20.8	-5.29		
12/26/2013	D1900V2	5d043	Head	1g	4.13	4.03	40.3	40.1	0.50	2.42	
				10g	2.15	2.07	20.7	21.1	-1.90		
12/30/2013	D2450V2	899	Head	1g	5.65	5.62	56.2	51.3	9.55	0.53	3,4
				10g	2.47	2.55	25.5	23.9	6.69		

SAR Lab B

Date Tested	System Dipole		T.S. Liquid		Measured Results			Target (Ref. Value)	Delta ±10 %	Est./Zoom Ratio ±3 %	Plot No.
	Type	Serial #			Area Scan	Zoom Scan	Normalize to 1 W				
12/30/2013	D2450V2	899	Body	1g	5.21	5.18	51.8	49.7	4.23	0.58	5,6
				10g	2.24	2.37	23.7	23.3	1.72		

SAR Lab D

Date Tested	System Dipole		T.S. Liquid	Measured Results			Target (Ref. Value)	Delta ±10 %	Est./Zoom Ratio ±3 %	Plot No.	
	Type	Serial #		Area Scan	Zoom Scan	Normalize to 1 W					
12/26/2013	D835V2	4d002	Head	1g	0.98	0.97	9.7	9.49	1.79	1.83	
				10g	0.663	0.632	6.3	6.18	2.27		
12/26/2013	D835V2	4d002	Body	1g	1.02	1.01	10.1	9.43	7.10	0.98	7,8
				10g	0.687	0.665	6.7	6.21	7.09		

12. SAR Test Results

12.1. GSM 850

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Voice	0	Left Touch	190	836.6	33.0	32.8	0.191	0.200	
			Left Tilt	190	836.6	33.0	32.8	0.136	0.142	
			Right Touch	190	836.6	33.0	32.8	0.221	0.231	
			Right Tilt	190	836.6	33.0	32.8	0.198	0.207	
Head	GPRS 2 Slots	0	Left Touch	190	836.6	31.5	31.3	0.257	0.269	
			Left Tilt	190	836.6	31.5	31.3	0.190	0.199	
			Right Touch	190	836.6	31.5	31.3	0.312	0.327	9
			Right Tilt	190	836.6	31.5	31.3	0.265	0.277	
Body-worn	Voice	10	Rear	190	836.6	33.0	32.8	0.364	0.381	10
			Front	190	836.6	33.0	32.8	0.241	0.252	
Hotspot	GPRS 2 Slots	10	Rear	190	836.6	31.5	31.3	0.506	0.530	11
			Front	190	836.6	31.5	31.3	0.236	0.247	
			Edge 2	190	836.6	31.5	31.3	0.318	0.333	
			Edge 3	190	836.6	31.5	31.3	0.126	0.132	
			Edge 4	190	836.6	31.5	31.3	0.201	0.210	

Note(s):

- 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
- With headset attached. According to KDB 648474 Section 2.3, 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.

12.2. GSM 1900

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	30.5	30.0	0.219	0.246	
			Left Tilt	661	1880.0	30.5	30.0	0.112	0.126	
			Right Touch	661	1880.0	30.5	30.0	0.315	0.353	
			Right Tilt	661	1880.0	30.5	30.0	0.119	0.134	
Head	GPRS 3 Slots	0	Left Touch	661	1880.0	27.0	26.2	0.248	0.298	
			Left Tilt	661	1880.0	27.0	26.2	0.128	0.154	
			Right Touch	661	1880.0	27.0	26.2	0.356	0.428	12
			Right Tilt	661	1880.0	27.0	26.2	0.134	0.161	
Body-worn	Voice	10	Rear	661	1880.0	30.5	30.0	0.674	0.756	13
			Front	661	1880.0	30.5	30.0	0.326	0.366	
Hotspot	GPRS 3 Slots	10	Rear	512	1850.2	27.0	26.1	0.573	0.705	
			Rear	661	1880.0	27.0	26.2	0.728	0.875	
			Rear	810	1909.8	27.0	26.0	0.839	1.056	14
			Front	661	1880.0	27.0	26.2	0.374	0.450	
			Edge 2	661	1880.0	27.0	26.2	0.191	0.230	
			Edge 3	661	1880.0	27.0	26.2	0.418	0.503	
			Edge 4	661	1880.0	27.0	26.2	0.074	0.089	

Note(s):

- 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
- With headset attached. According to KDB 648474 Section 2.3, 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.

12.3. W-CDMA Band V

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Rel 99 RMC	0	Left Touch	4183	836.6	23.0	22.4	0.168	0.193	15
			Left Tilt	4183	836.6	23.0	22.4	0.110	0.126	
			Right Touch	4183	836.6	23.0	22.4	0.202	0.232	
			Right Tilt	4183	836.6	23.0	22.4	0.127	0.146	
Body-worn & Hotspot	Rel 99 RMC	10	Rear	4183	836.6	23.0	22.4	0.313	0.359	16
			Front	4183	836.6	23.0	22.4	0.234	0.269	
Hotspot	Rel 99 RMC	10	Edge 2	4183	836.6	23.0	22.4	0.181	0.208	
			Edge 3	4183	836.6	23.0	22.4	0.079	0.090	
			Edge 4	4183	836.6	23.0	22.4	0.108	0.124	

Note(s):

- 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
- With headset attached. According to KDB 648474 Section 2.3, 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.

12.4. Wi-Fi (DTS Bands)

RF Exposure Conditions	Test Position	Mode	Dist. (mm)	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Left Touch	802.11b	0	6	2437	14.5	14.5	0.309	0.309	17
	Left Tilt	802.11b	0	6	2437	14.5	14.5	0.200	0.200	
	Right Touch	802.11b	0	6	2437	14.5	14.5	0.145	0.145	
	Right Tilt	802.11b	0	6	2437	14.5	14.5	0.153	0.153	
Body worn & Hotspot	Rear	802.11b	10	6	2437	14.5	14.5	0.074	0.074	18
	Front	802.11b	10	6	2437	14.5	14.5	0.068	0.068	
Hotspot	Edge 1	802.11b	10	6	2437	14.5	14.5	0.065	0.065	
	Edge 2	802.11b	10	6	2437	14.5	14.5	0.061	0.061	

Note(s):

- 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
- With headset attached. According to KDB 648474 Section 2.3, 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.

12.5. Bluetooth

12.5.1. 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)			
9.5	9	10	2.480	1.4

Conclusion:

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

12.5.2. 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	10	10	2.480	0.199

13. SAR Measurement Variability

In accordance with published RF Exposure KDB procedure 865664 D01 SAR measurement 100 MHz to 6 GHz v01r01. 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 .

13.1. The Highest Measured SAR Configuration in Each Frequency Band

Frequency Band (MHz)	Air Interface	Head (W/kg)	Body-worn Accessory (W/kg)	Hotspot/Wi-Fi Direct (W/kg)
850	GSM 850			0.506
	W-CDMA Band V		0.313	
1900	GSM 1900			0.839
2400	Wi-Fi 802.11b/g/n	0.309		

13.2. Repeated Measurement Results

Head Exposure Condition

Not Applicable.

Body-worn Accessory Exposure Condition

Not Applicable.

Hotspot Mode Exposure Conditions

Frequency band	Test Position	Mode	Ch #.	Freq. (MHz)	Meas. SAR (W/kg)		Largest to Smallest SAR Ratio	Note
					Original	Repeated		
GSM 1900	Rear	GPRS 3 slots	810	1909.8	0.839	0.812	1.03	1

Note(s):

1. 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 .

14. 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:

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

14.1. Sum of the SAR for GSM 850, Wi-Fi, and BT

RF Exposure conditions	Test Position	Simultaneous Transmission Scenario			Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
		GSM 850	WiFi DTS Band	Bluetooth		
Head	Left Touch	0.269	0.309		0.578	No
	Left Tilt	0.199	0.200		0.399	No
	Right Touch	0.327	0.145		0.472	No
	Right Tilt	0.277	0.153		0.430	No
Body-worn	Rear	0.381	0.074		0.455	No
		0.381		0.199	0.580	No
	Front	0.252	0.068		0.320	No
		0.252		0.199	0.451	No
Hotspot	Rear	0.530	0.074		0.604	No
	Front	0.247	0.068		0.315	No
	Edge 1	0.000	0.065		0.065	No
	Edge 2	0.333	0.061		0.394	No
	Edge 3	0.132			0.132	No
	Edge 4	0.210			0.210	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.

14.2. Sum of the SAR for GSM 1900, Wi-Fi, and BT

RF Exposure conditions	Test Position	Simultaneous Transmission Scenario			Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
		GSM 1900	WiFi DTS Band	Bluetooth		
Head	Left Touch	0.298	0.309		0.607	No
	Left Tilt	0.154	0.200		0.354	No
	Right Touch	0.428	0.145		0.573	No
	Right Tilt	0.161	0.153		0.314	No
Body-worn	Rear	0.756	0.074		0.830	No
		0.756		0.199	0.955	No
	Front	0.366	0.068		0.434	No
		0.366		0.199	0.565	No
Hotspot	Rear	1.056	0.074		1.130	No
	Front	0.450	0.068		0.518	No
	Edge 1	0.000	0.065		0.065	No
	Edge 2	0.230	0.061		0.291	No
	Edge 3	0.503			0.503	No
	Edge 4	0.089			0.089	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.

14.3. Sum of the SAR for W-CDMA Band V, Wi-Fi, and BT

RF Exposure conditions	Test Position	Simultaneous Transmission Scenario			Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
		W-CDMA Band V	WiFi DTS Band	Bluetooth		
Head	Left Touch	0.193	0.309		0.502	No
	Left Tilt	0.126	0.200		0.326	No
	Right Touch	0.232	0.145		0.377	No
	Right Tilt	0.146	0.153		0.299	No
Body-worn	Rear	0.359	0.074		0.433	No
		0.359		0.199	0.558	No
	Front	0.269	0.068		0.337	No
		0.269		0.199	0.468	No
Hotspot	Rear	0.359	0.074		0.433	No
	Front	0.269	0.068		0.337	No
	Edge 1	0.000	0.065		0.065	No
	Edge 2	0.208	0.061		0.269	No
	Edge 3	0.090			0.090	No
	Edge 4	0.124			0.124	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.

15. Appendixes

Refer to separated files for the following appendixes.

- 15.1. Photos and Antenna Locations**
- 15.2. System Performance Check Plots**
- 15.3. Highest SAR Test Plots**
- 15.4. Calibration Certificate for E-Field Probe EX3DV4 - SN 3749**
- 15.5. Calibration Certificate for E-Field Probe EX3DV4 - SN 3772**
- 15.6. Calibration Certificate for E-Field Probe EX3DV4 - SN 3686**
- 15.7. Calibration Certificate for D835V2- SN 4d002**
- 15.8. Calibration Certificate for D1900V2- SN 5d043**
- 15.9. Calibration Certificate for D2450V2 - SN 899**

END OF REPORT