



**FCC OET BULLETIN 65 SUPPLEMENT C 01-01
IEEE Std 1528-2003 and IEEE Std 1528a-2005**

SAR EVALUATION REPORT

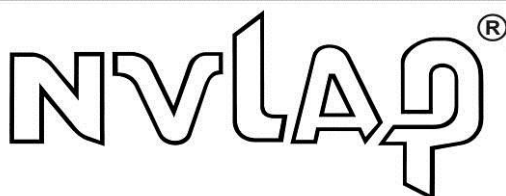
For
GSM1900 Phone with WiFi/BT

**Model: GT-I9128I
FCC ID: A3LGTI9128I**

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Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
--	6/19/2013	Initial Issue	--
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1. Attestation of Test Results

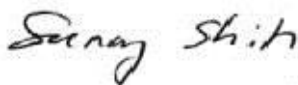
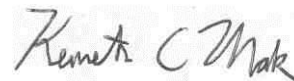
Applicant	Samsung Electronics Co., Ltd.			
DUT description	GSM1900 Phone with WiFi/BT			
Model	GT-I9128I			
Test device is	An identical prototype			
Device category	Portable			
Exposure category	General Population/Uncontrolled Exposure			
Date tested	6/10/2013 – 6/13/2013			
The highest reported SAR values	RF exposure condition	Licensed	DTS	UNII
	Head	0.314 W/kg	0.038 W/kg	N/A
	Body-worn Accessory	0.487 W/kg	0.125 W/kg	N/A
	Wireless Router (Hotspot)	0.487 W/kg	0.125 W/kg	N/A
	Simultaneous Transmission	0.612 W/kg	0.612 W/kg	N/A
Applicable Standards	OET Bulletin 65 Supplement C IEEE Std 1528-2003 and IEEE Std 1528a-2005 FCC Published RF exposure KDB procedures, and TCB workshop updates			
Test Results	Pass			

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

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

Approved & Released By:

Prepared By:

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WiSE Operations Manager
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UL Verification Services Inc.

2. Test Methodology

The tests documented in this report were performed in accordance with FCC OET Bulletin 65 Supplement C Edition 01-01, IEEE STD 1528-2003, IEEE Std 1528a-2005, the following FCC Published RF exposure KDB procedures and TCB workshop updates:

- 447498 D01 General RF Exposure Guidance v05r01
- 648474 D04 Handsets v01r01
- 941225 D03 SAR Test Reduction GSM GPRS EDGE v01
- 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r01
- 248227 D01 SAR meas for 802.11abg v01r02
- 865664 D02 SAR Reporting v01r01
- 690783 D01 SAR Listings on Grants v01r02

3. Facilities and Accreditation

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

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	MY40001647	6/27/2013
Dielectronic Probe kit	SPEAG	DAK-3.5	1087	10/16/2013
Thermometer	TRACEABLE	4242	122529162	9/19/2014
Network Analyzer	Agilent	8753ES	MY40000980	2/20/2014
Dielectronic Probe kit	SPEAG	DAK-3.5	1082	9/18/2013
Thermometer	TRACEABLE	4242	122529163	9/19/2013

System Performance Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due date
Synthesized Signal Generator	HP	8665B	3744A01084	3/26/2014
Power Meter	HP	438A	3513U04320	9/24/2013
Power Sensor	HP	8481A	2237A31744	9/24/2013
Power Sensor	HP	8481A	3318A95392	9/24/2013
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1620606	N/A
Directional coupler	Werlatone	C8060-102	2141	N/A
DC Power Supply	HP	6296A	2410A-05117	N/A
Synthesized Signal Generator	HP	8665B	3744A01155	3/6/2014
Power Meter	HP	438A	2822A05684	10/7/2013
Power Sensor	HP	8481A	2702A66876	9/24/2013
Power Sensor	HP	8482A	2349A08568	9/26/2013
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1622052	N/A
Directional coupler	Werlatone	C8060-102	2149	N/A
DC Power Supply	EKNWOOD	PA36-3A	7060074	N/A
System Validation Dipole	SPEAG	D1900V2	5d163	10/4/2013
System Validation Dipole	SPEAG	D2450V2	899	10/5/2013
Thermometer	TRACEABLE	4242	122529162	9/19/2013
Thermometer	TRACEABLE	4242	122529163	9/19/2013
E-Field Probe (SAR A)	SPEAG	EX3DV4	3749	1/15/2014
E-Field Probe (SAR B)	SPEAG	EX3DV4	3751	11/15/2013
E-Field Probe (SAR 1)	SPEAG	EX3DV3	3531	11/15/2013
Data Acquisition Electronics (SAR A)	SPEAG	DAE4	1343	8/20/2013
Data Acquisition Electronics (SAR B)	SPEAG	DAE3	427	1/9/2014
Data Acquisition Electronics (SAR 1)	SPEAG	DAE4	1259	2/7/2014

Others

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due date
Base Station Simulator	Agilent	8960	GB46160222	11/10/2013
Base Station Simulator	R & S	CMU200	106291	8/8/2013
Power Meter	Agilent	N1912A	MY50001018	8/10/2013
Power Sensor	Agilent	N1921A	MY52200012	7/24/2013

4.2.Measurement Uncertainty

Measurement uncertainty for 30 MHz to 3 GHz averaged over 1 gram (Head)

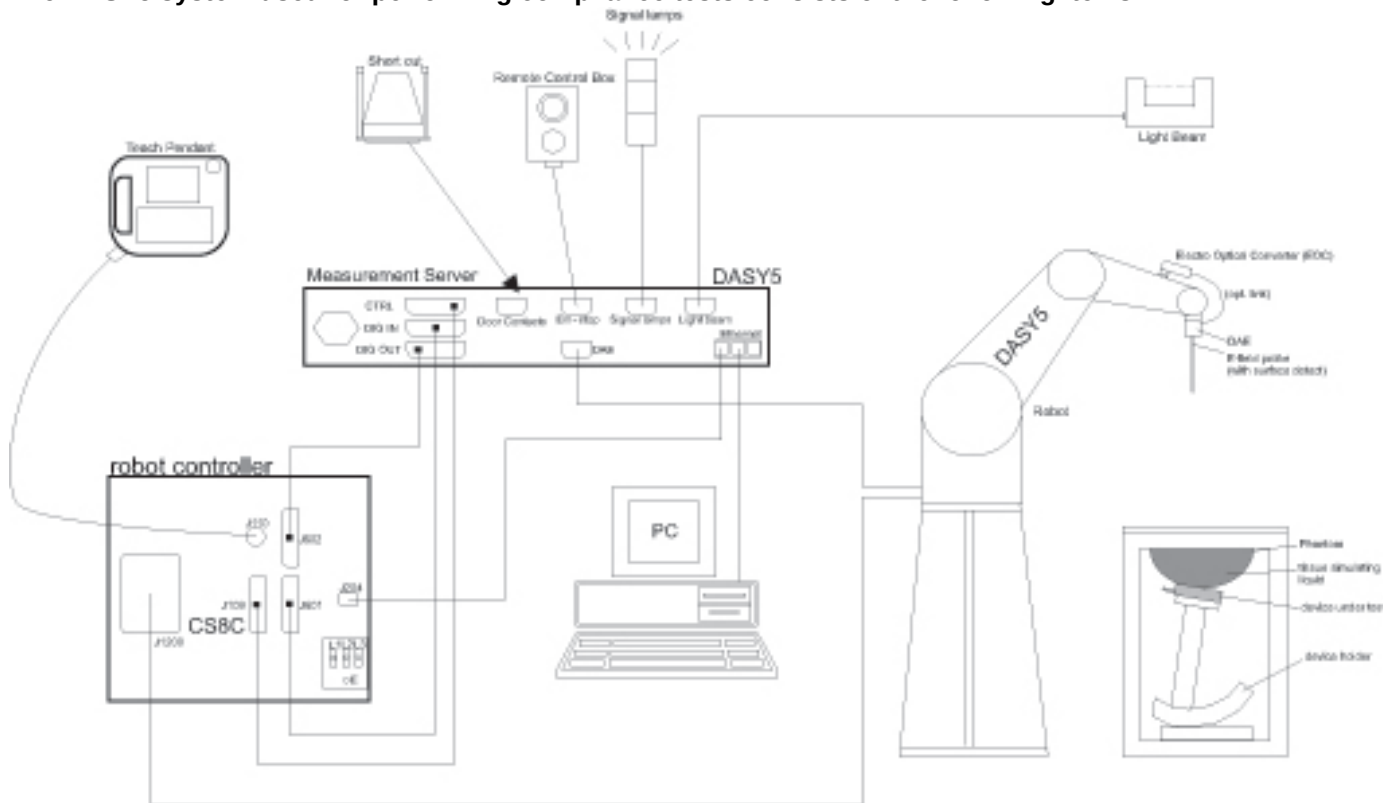
Component	Error, ±%	Prob Dist	Divisor	Sensitivity	U (X), %
Measurement System					
Probe Calibration (k=1)	6.00	Normal	1	1	6.00
Axial Isotropy	1.15	Rectangular	1.732	0.7	0.46
Hemispherical Isotropy	2.30	Rectangular	1.732	0.7	0.93
Boundary Effect	0.90	Rectangular	1.732	1	0.52
Probe Linearity	3.45	Rectangular	1.732	1	1.99
Modulation Response	2.40	Rectangular	1.732	1	1.39
System Detection Limits	1.00	Rectangular	1.732	1	0.58
Readout Electronics	0.30	Normal	1	1	0.30
Response Time	0.80	Rectangular	1.732	1	0.46
Integration Time	2.60	Rectangular	1.732	1	1.50
RF Ambient Noise	3.00	Rectangular	1.732	1	1.73
RF Ambient Reflections	3.00	Rectangular	1.732	1	1.73
Probe Positioner	0.40	Rectangular	1.732	1	0.23
Probe Positioning	2.90	Rectangular	1.732	1	1.67
Max.SAR Eval.	2.00	Rectangular	1.732	1	1.15
Test Sample Related					
Test Sample Positioning	2.90	Normal	1	1	2.90
Device Holder	3.60	Normal	1	1	3.60
Power Drift	5.00	Rectangular	1.732	1	2.89
Power Scaling	0.00	Rectangular	1.732	1	0.00
Phantom and Setup					
Phantom Uncertainty	6.10	Rectangular	1.732	1	3.52
SAR Correction	1.90	Rectangular	1.732	1	1.10
Liquid Permittivity - measurement	-2.53	Rectangular	1.732	0.26	-0.38
Liquid Conductivity - measurement	4.68	Rectangular	1.732	0.78	2.11
Liquid Permittivity - temperature uncertainty	0.40	Rectangular	1.732	0.23	0.05
Liquid Conductivity - temperature uncertainty	3.40	Rectangular	1.732	0.78	1.53
Combined Standard Uncertainty Uc(y) =					10.15
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =				20.30 %	
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =				1.61 dB	

Measurement uncertainty for 30 MHz to 6 GHz averaged over 1 gram (Body)

Component	Error, ±%	Prob Dist	Divisor	Sensitivity	U (X), %
Measurement System					
Probe Calibration (k=1)	6.55	Normal	1	1	6.55
Axial Isotropy	1.15	Rectangular	1.732	0.7	0.46
Hemispherical Isotropy	2.30	Rectangular	1.732	0.7	0.93
Boundary Effect	0.90	Rectangular	1.732	1	0.52
Probe Linearity	3.45	Rectangular	1.732	1	1.99
Modulation Response	2.40	Rectangular	1.732	1	1.39
System Detection Limits	1.00	Rectangular	1.732	1	0.58
Readout Electronics	0.30	Normal	1	1	0.30
Response Time	0.80	Rectangular	1.732	1	0.46
Integration Time	2.60	Rectangular	1.732	1	1.50
RF Ambient Noise	3.00	Rectangular	1.732	1	1.73
RF Ambient Reflections	3.00	Rectangular	1.732	1	1.73
Probe Positioner	0.80	Rectangular	1.732	1	0.46
Probe Positioning	6.70	Rectangular	1.732	1	3.87
Max.SAR Eval.	4.00	Rectangular	1.732	1	2.31
Test Sample Related					
Test Sample Positioning	2.90	Normal	1	1	2.90
Device Holder	3.60	Normal	1	1	3.60
Power Drift	5.00	Rectangular	1.732	1	2.89
Power Scaling	0.00	Rectangular	1.732	1	0.00
Phantom and Setup					
Phantom Uncertainty	7.90	Rectangular	1.732	1	4.56
SAR Correction	1.90	Rectangular	1.732	1	1.10
Liquid Permittivity - measurement	-3.43	Rectangular	1.732	0.26	-0.51
Liquid Conductivity - measurement	3.69	Rectangular	1.732	0.78	1.66
Liquid Permittivity - temperature uncertainty	0.40	Rectangular	1.732	0.23	0.05
Liquid Conductivity - temperature uncertainty	3.40	Rectangular	1.732	0.78	1.53
Combined Standard Uncertainty Uc(y) =					11.54
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =				23.07 %	
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =				1.80 dB	

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 <i>1-g SAR estimation</i> 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

GSM1900 Phone with WiFi/BT Model: GT-I9128I	
Operating Configuration(s)	Held to head, Body-worn (Voice call, VoIP)
Mobile Hotspot	WiFi Hotspot mode permits the device to share its cellular data connection with other WiFi-enabled devices. ☒ Mobile Hotspot (WiFi 2.4 GHz) ☐ Mobile Hotspot (WiFi 5 GHz)
WiFi Direct	Wi-Fi Direct enabled devices transfer data directly between each other ☒ WiFi Direct (WiFi 2.4 GHz) ☐ WiFi Direct (WiFi 5 GHz)
RF Exposure Condition(s)	☒ Head, ☒ Body-worn Accessory, ☒ Hotspot (Wireless router)
Device Dimensions	Overall (Length x Width): 144 mm x 77 mm Overall Diagonal: 149.5 mm Display Diagonal: 127.3 mm
Accessory	Headset
Battery Options	☒ Standard – Li-ion battery, 3.8 V, 2100 mAh ☐ Extended (large capacity)

7.2. Wireless Technologies

Wireless Mode and Frequency Bands	GSM1900, WiFi 2.4 GHz Bluetooth 2.4 GHz
Modulation	GSM (GMSK) / GPRS (GMSK) / EGPRS (8PSK), WiFi 802.11b/g/n Bluetooth Ver. 4.0 (LE)
Duty Cycle	GSM Voice: 12.5%; GPRS 1 Slot: 12.5%; 2 Slots: 25%; 3 Slots: 37.5%; 4 Slots: 50% WiFi: 100%
GPRS Multi-Slot Class	☐ Class 8 - One Up; ☐ Class 10 - Two Up; ☒ Class 12 - Four Up
VoIP (GPRS)	☒ Supported
Mobile Phone Capability	☐ Class A - Mobile phones can be connected to both GPRS and GSM services simultaneously. ☒ Class B - Mobile phones can be attached to both GPRS and GSM services, using one service at a time. ☐ Class C - Mobile phones are attached to either GPRS or GSM voice service. You need to switch manually between services

7.3. Simultaneous Transmission Condition

RF Exposure Condition	Capable Transmit Configurations
Head	GSM1900 MHz Voice + WiFi 2.4 GHz GSM1900 MHz Data + WiFi 2.4 GHz (VoIP)
Body-worn Accessory	GSM1900 MHz Voice + WiFi 2.4 GHz GSM1900 MHz Data + WiFi 2.4 GHz (VoIP) GSM1900 MHz Voice + BT GSM1900 MHz Data + BT (VoIP)
Wireless Router (Hotspot)	GSM1900 MHz Data + WiFi 2.4 GHz
Note: WiFi cannot transmit simultaneously with Bluetooth.	

8. RF Exposure Conditions

Refer to Section 17 "Antenna Locations and Separation Distances" for the specific details of the antenna-to-antenna, antenna-to-edge(s) distances, and device orientation description.

8.1. Head Exposure Conditions

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

8.2. Body-worn Accessory Exposure Conditions

GSM

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	1.0 mm	Yes	
Front	3.0 mm	Yes	

WiFi

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	1.0 mm	Yes	
Front	7.0 mm	Yes	

8.3. Hotspot Mode Exposure Conditions

GSM

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	1.0 mm	Yes	
Front	3.0 mm	Yes	
Edge 1 (Top)	123 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 v01
Edge 2 (Right)	5 mm	Yes	
Edge 3 (Bottom)	<10 mm	Yes	
Edge 4 (Left)	48 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 v01

WiFi

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	1.0 mm	Yes	
Front	7.0 mm	Yes	
Edge 1 (Top)	58 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 v01
Edge 2 (Right)	63 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 v01
Edge 3 (Bottom)	62 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 v01
Edge 4 (Left)	5.0 mm	Yes	

9. RF Output Power Measurement

9.1. GSM1900

	Min	Max
Tune-up Tolerance (dB):	-1.5	0.5

Output Power Tolerance (dBm)	Voice	GPRS 1 slot	GPRS 2 slots	GPRS 3 slots	GPRS 4 slots	EGPRS 1 slot	EGPRS 2 slots	EGPRS 3 slots	EGPRS 4 slots
Max	30.0	30.0	29.0	28.0	27.0	25.5	24.5	22.0	21.5
Target	29.5	29.5	28.5	27.5	26.5	25.0	24.0	21.5	21.0
Min	28.0	28.0	27.0	26.0	25.0	23.5	22.5	20.0	19.5

Test Results

GSM (GMSK) - Voice Mode

Band	Ch No.	Freq. (MHz)	Avg burst Pwr (dBm)
1900	512	1850.2	29.7
	661	1880.0	29.6
	810	1909.8	29.4

GPRS (GMSK) - Coding Scheme: CS1

Band	Ch No.	Freq. (MHz)	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	29.7	20.7	29.0	23.0	27.6	23.3	26.3	23.3
	661	1880.0	29.6	20.6	28.9	22.9	27.6	23.3	26.2	23.2
	810	1909.8	29.4	20.4	28.7	22.7	27.6	23.3	26.2	23.2

EGPRS (8PSK) - Coding Scheme: MCS5

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	26.1	17.1	24.9	18.9	22.2	17.9	21.6	18.6
	661	1880.0	26.0	17.0	24.8	18.8	22.1	17.8	21.6	18.6
	810	1909.8	25.8	16.8	24.7	18.7	22.0	17.7	21.5	18.5

Notes:

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

- Head & Body-worn Accessory: GMSK Voice Mode
- Hotspot mode: GMSK (GPRS) mode with 3 time slots, based on the output power measurements above
- SAR is not required for EGPRS (8PSK) mode because its output power is less than that of GPRS mode

9.2. WiFi (2.4 GHz Band)

	Min	Max
Tune-up Tolerance (dB):	-1.5	0.5

Output Power Tolerance	IEEE 802.11 (dBm)		
	b	g	n (HT20)
Max	16.5	13.5	12.5
Target	16.0	13.0	12.0
Min	14.5	11.5	10.5

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.

Band (MHz)	Mode	Ch #	Freq. (MHz)	Avg Pwr (dBm)
2.4	802.11b	1	2412	15.7
		6	2437	15.6
		11	2462	15.7
	802.11g	1	2412	13.3
		6	2437	13.1
		11	2462	13.3
	802.11n (HT20)	1	2412	12.2
		6	2437	12.0
		11	2462	12.2

Note(s):

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

9.3. Bluetooth

Maximum tune-up tolerance limit is 10.5 dBm from the rated nominal maximum output power. This power level qualifies for exclusion of SAR testing.

Refer to Section 12.3. Standalone SAR Test Exclusion Considerations

10. Tissue Dielectric Properties

IEEE Std 1528-2003 Table 2

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 OET Bulletin 65 Supplement C 01-01

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

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 Room A

	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit $\pm$ (%)
6/12/2013	Head 2450	e'	39.0700	Relative Permittivity (ϵ_r):	39.07	39.20	-0.33	5
		e''	13.7200	Conductivity (σ):	1.87	1.80	3.84	5
	Head 2410	e'	39.2200	Relative Permittivity (ϵ_r):	39.22	39.28	-0.15	5
		e''	13.6100	Conductivity (σ):	1.82	1.76	3.60	5
	Head 2475	e'	39.0000	Relative Permittivity (ϵ_r):	39.00	39.17	-0.43	5
		e''	13.8100	Conductivity (σ):	1.90	1.83	4.02	5

SAR Room B

	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
6/10/2013	Head 1900	e'	39.0500	Relative Permittivity (ε _r):	39.05	40.00	-2.38	5
		e''	13.7700	Conductivity (σ):	1.45	1.40	3.91	5
	Head 1850	e'	39.2700	Relative Permittivity (ε _r):	39.27	40.00	-1.82	5
		e''	13.6900	Conductivity (σ):	1.41	1.40	0.59	5
	Head 1910	e'	38.9900	Relative Permittivity (ε _r):	38.99	40.00	-2.53	5
		e''	13.8000	Conductivity (σ):	1.47	1.40	4.68	5
6/10/2013	Body 1900	e'	52.1400	Relative Permittivity (ε _r):	52.14	53.30	-2.18	5
		e''	14.7900	Conductivity (σ):	1.56	1.52	2.80	5
	Body 1850	e'	52.2000	Relative Permittivity (ε _r):	52.20	53.30	-2.06	5
		e''	14.6500	Conductivity (σ):	1.51	1.52	-0.86	5
	Body 1910	e'	52.1300	Relative Permittivity (ε _r):	52.13	53.30	-2.20	5
		e''	14.8400	Conductivity (σ):	1.58	1.52	3.69	5
6/13/2013	Body 1900	e'	51.5000	Relative Permittivity (ε _r):	51.50	53.30	-3.38	5
		e''	14.5300	Conductivity (σ):	1.54	1.52	0.99	5
	Body 1850	e'	51.6900	Relative Permittivity (ε _r):	51.69	53.30	-3.02	5
		e''	14.4200	Conductivity (σ):	1.48	1.52	-2.41	5
	Body 1910	e'	51.4700	Relative Permittivity (ε _r):	51.47	53.30	-3.43	5
		e''	14.5600	Conductivity (σ):	1.55	1.52	1.73	5

SAR Room 1

	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
6/11/2013	Body 2450	e'	52.7000	Relative Permittivity (ε _r):	52.70	52.70	0.00	5
		e''	13.9900	Conductivity (σ):	1.91	1.95	-2.27	5
	Body 2410	e'	52.8300	Relative Permittivity (ε _r):	52.83	52.76	0.13	5
		e''	13.8100	Conductivity (σ):	1.85	1.91	-2.98	5
	Body 2475	e'	52.5900	Relative Permittivity (ε _r):	52.59	52.67	-0.15	5
		e''	14.0800	Conductivity (σ):	1.94	1.99	-2.39	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
D1900V2	5d163	10/04/2012	1900	1g	39.4	39.6
				10g	20.7	21.1
D2450V2	899	10/05/2012	2450	1g	53.6	51.7
				10g	25.0	24.3

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 Room 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				
6/12/2013	D2450V2	899	Head	1g	5.59	5.52	55.20	53.6	2.99	1.25	1,2
				10g	2.40	2.51	25.10	25.0	0.40		

SAR Room 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				
6/10/2013	D1900V2	5d163	Head	1g	4.24	4.16	41.60	39.4	5.58	1.89	3,4
				10g	2.24	2.13	21.30	20.7	2.90		
6/10/2013	D1900V2	5d163	Body	1g	4.06	4.03	40.30	39.6	1.77	0.74	
				10g	2.06	2.08	20.80	21.1	-1.42		
6/13/2013	D1900V2	5d163	Body	1g	4.17	4.13	41.30	39.6	4.29	0.96	
				10g	2.10	2.15	21.50	21.1	1.90		

SAR Room 1

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				
6/11/2013	D2450V2	899	Body	1g	5.01	5.07	50.70	51.7	-1.93	-1.20	5,6
				10g	2.19	2.40	24.00	24.3	-1.23		

12. SAR Test Results

12.1. GSM1900

12.1.1. Head Exposure Conditions

Test Position	Mode	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.	Note
				Tune-up limit	Meas.	Meas.	Scaled		
Left Touch	Voice	512	1850.2	30.0	29.7				1
		661	1880.0	30.0	29.6	0.081	0.089		
		810	1909.8	30.0	29.4				1
Left Tilt (15°)	Voice	512	1850.2	30.0	29.7				1
		661	1880.0	30.0	29.6	0.040	0.044		
		810	1909.8	30.0	29.4				1
Right Touch	Voice	512	1850.2	30.0	29.7				1
		661	1880.0	30.0	29.6	0.134	0.147	1	
		810	1909.8	30.0	29.4				1
Right Tilt (15°)	Voice	512	1850.2	30.0	29.7				1
		661	1880.0	30.0	29.6	0.041	0.045		
		810	1909.8	30.0	29.4				1

Head Exposure Conditions (VoIP mode)

Test Position	Mode	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.	Note
				Tune-up limit	Meas.	Meas.	Scaled		
Left Touch	GPRS 3 Slots	512	1850.2	28.0	27.6				1
		661	1880.0	28.0	27.6	0.180	0.197		
		810	1909.8	28.0	27.6				1
Left Tilt (15°)	GPRS 3 Slots	512	1850.2	28.0	27.6				1
		661	1880.0	28.0	27.6	0.088	0.097		
		810	1909.8	28.0	27.6				1
Right Touch	GPRS 3 Slots	512	1850.2	28.0	27.6				1
		661	1880.0	28.0	27.6	0.286	0.314	2	
		810	1909.8	28.0	27.6				1
Right Tilt (15°)	GPRS 3 Slots	512	1850.2	28.0	27.6				1
		661	1880.0	28.0	27.6	0.096	0.105		
		810	1909.8	28.0	27.6				1

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

12.1.2. Body-worn Accessory Exposure Conditions

Voice Mode

Test Position	Mode	Dist. (mm)	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.	Note
					Tune-up limit	Meas.	Meas.	Scaled		
Rear	Voice	10	512	1850.2	30.0	29.7				1
			661	1880.0	30.0	29.6	0.220	0.241	3	
			810	1909.8	30.0	29.4				1
Front	Voice	10	512	1850.2	30.0	29.7				1
			661	1880.0	30.0	29.6	0.198	0.217		
			810	1909.8	30.0	29.4				1

VoIP mode

Test Position	Mode	Dist. (mm)	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.	Note
					Tune-up limit	Meas.	Meas.	Scaled		
Rear	GPRS 3 Slots	10	512	1850.2	28.0	27.6				1
			661	1880.0	28.0	27.6	0.444	0.487	4	
			810	1909.8	28.0	27.6				1
Front	GPRS 3 Slots	10	512	1850.2	28.0	27.6				1
			661	1880.0	28.0	27.6	0.443	0.486		
			810	1909.8	28.0	27.6				1

12.1.3. Hotspot Mode Exposure Conditions

Test Position	Mode	Dist. (mm)	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.	Note
					Tune-up limit	Meas.	Meas.	Scaled		
Rear	GPRS 3 Slots	10	512	1850.2	28.0	27.6				1
			661	1880.0	28.0	27.6	0.444	0.487	4	
			810	1909.8	28.0	27.6				1
Front	GPRS 3 Slots	10	512	1850.2	28.0	27.6				1
			661	1880.0	28.0	27.6	0.443	0.486		
			810	1909.8	28.0	27.6				1
Edge 2	GPRS 3 Slots	10	512	1850.2	28.0	27.6				1
			661	1880.0	28.0	27.6	0.225	0.247		
			810	1909.8	28.0	27.6				1
Edge 3	GPRS 3 Slots	10	512	1850.2	28.0	27.6				1
			661	1880.0	28.0	27.6	0.357	0.391		
			810	1909.8	28.0	27.6				1

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

12.2. Wi-Fi (2.4 GHz Band)

12.2.1. Head Exposure Conditions

Test Position	Mode	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.	Note
				Tune-up limit	Meas.	Meas.	Scaled		
Left Touch	802.11b	1	2412	16.5	15.7	0.032	0.038	5	
		6	2437	16.5	15.6				1
		11	2462	16.5	15.7				1
Left Tilt (15°)	802.11b	1	2412	16.5	15.7	0.013	0.016		
		6	2437	16.5	15.6				1
		11	2462	16.5	15.7				1
Right Touch	802.11b	1	2412	16.5	15.7	0.032	0.038	6	
		6	2437	16.5	15.6				1
		11	2462	16.5	15.7				1
Right Tilt (15°)	802.11b	1	2412	16.5	15.7	0.0065	0.008		
		6	2437	16.5	15.6				1
		11	2462	16.5	15.7				1

12.2.2. Body-worn Accessory & Hotspot Mode Exposure Conditions

Body-worn Accessory & Hotspot Mode Exposure Conditions

Test Position	Mode	Dist. (mm)	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.	Note
					Tune-up limit	Meas.	Meas.	Scaled		
Rear	802.11b	10	1	2412	16.5	15.7	0.104	0.125	7	
			6	2437	16.5	15.6				1
			11	2462	16.5	15.7				1
Front	802.11b	10	1	2412	16.5	15.7	0.020	0.024		
			6	2437	16.5	15.6				1
			11	2462	16.5	15.7				1

Hotspot Mode Exposure Conditions

Test Position	Mode	Dist. (mm)	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.	Note
					Tune-up limit	Meas.	Meas.	Scaled		
Edge 4	802.11b	10	1	2412	16.5	15.7	0.061	0.073		
			6	2437	16.5	15.6				1
			11	2462	16.5	15.7				1

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

12.3. Bluetooth

12.3.1. 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)			
10.5	11	10	2.480	1.8

Conclusion:

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

12.3.2. 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	11	10	2.480	0.231

13. SAR Measurement Variability

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

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

13.1. The Highest Measured SAR Configuration in Each Frequency Band

Head Exposure Condition

Not Applicable. Highest measured SAR is < 0.80 W/kg.

Body-worn Accessory Exposure Condition

Not Applicable. Highest measured SAR is < 0.80 W/kg.

Hotspot Mode Exposure Condition

Not Applicable. Highest measured SAR is < 0.80 W/kg.

13.2. Repeated Measurement Results

Head Exposure Condition

Not Applicable. Highest measured SAR is < 0.80 W/kg.

Body-worn Accessory Exposure Condition

Not Applicable. Highest measured SAR is < 0.80 W/kg.

Hotspot Mode Exposure Condition

Not Applicable. Highest measured SAR is < 0.80 W/kg.

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. Head Exposure Conditions

Sum of the SAR for GSM (Voice) & WiFi

Test Position	Voice	Data	Σ 1-g SAR (mW/g)
	GSM 1900	WiFi 2.4 GHz	
Left Touch	0.089	0.038	0.127
Left Tilt (15°)	0.044	0.016	0.060
Right Touch	0.147	0.038	0.185
Right Tilt (15°)	0.045	0.008	0.053

Sum of the SAR for GSM (VoIP) & WiFi

Test Position	VoIP (GPRS)	Data	Σ 1-g SAR (mW/g)
	GSM 1900	WiFi 2.4 GHz	
Left Touch	0.197	0.038	0.235
Left Tilt (15°)	0.097	0.016	0.113
Right Touch	0.314	0.038	0.352
Right Tilt (15°)	0.105	0.008	0.113

SAR to Peak Location Separation Ratio (SPLSR)

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

Conclusion:

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

14.2. Body-worn Accessory Exposure Conditions

Sum of the SAR for GSM (Voice), WiFi, and BT

Test Position	Voice	Data	Data	Σ 1-g SAR (mW/g)
	GSM 1900	WiFi 2.4 GHz	Bluetooth 2.4 GHz	
Rear	0.241	0.125		0.366
	0.241		0.231	0.472
Front	0.217	0.024		0.241
	0.217		0.231	0.448

Sum of the SAR for GSM (VoIP), WiFi, and BT

Test Position	VoIP	Data	Data	Σ 1-g SAR (mW/g)
	GSM 1900	WiFi 2.4 GHz	Bluetooth 2.4 GHz	
Rear	0.487	0.125		0.612
	0.487		0.231	0.718
Front	0.486	0.024		0.510
	0.486		0.231	0.717

SAR to Peak Location Separation Ratio (SPLSR)

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

Conclusion:

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

14.3. Hotspot Mode Exposure Conditions

Sum of the SAR for GSM & WiFi

Test Position	VoIP	Data	Σ 1-g SAR (mW/g)
	GSM 1900	WiFi 2.4 GHz	
Rear	0.487	0.125	0.612
Front	0.486	0.024	0.510
Edge 2	0.247	0.000	0.247
Edge 3	0.391	0.000	0.391

15. Appendixes

Refer to separated files for the following appendixes.

15.1. System Performance Check Plots

15.2. Highest SAR Test Plots

SAR plot is required for the highest measured SAR in each exposure configuration, wireless mode and frequency band combination; for example, WCDMA head SAR at 1900 MHz. Plots are also required when the measured SAR is > 1.5 W/kg for occupational exposure.

15.3. Calibration Certificate for E-Field Probe EX3DV4 - SN 3531

15.4. Calibration Certificate for E-Field Probe EX3DV4 - SN 3749

15.5. Calibration Certificate for E-Field Probe EX3DV4 - SN 3751

15.6. Calibration Certificate for D1900V2 - SN 5d163

15.7. Calibration Certificate for D2450V2 - SN 899