



**FCC 47 CFR Parts 1 & 2
Published RF Exposure KDB Procedures
IEEE Std 1528-2003 and IEEE 1528a-2005**

SAR EVALUATION REPORT

For

1x1 802.11abgn+BT4.0+Basic+EDR+HS,GSM1900,WCDMA1900, LTE B5+NFC

**Model: SM-C105S and SM-C105L
FCC ID: A3LSMC105S**

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Prepared for

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<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
--	8/27/2013	Initial Issue	--
A	9/9/2013	1. Sec. 7.1., 7.4.: Added WiFi Direct mode. 2. Sec. 7.3.: Updated LTE Band Output Power Tune-up Tolerance. 3. Sec. 9.3.: Updated 5MHz Bandwidth output power. 4. Sec. 9.4. and 9.5.: Added Power measurements to determine worst-case data rates. 5. Sec. 12.4., 14.1., 14.2. and 14.3.: Added WiFi Direct mode SAR test results.	Devin Chang
B	9/18/2013	Sec. 9.3: Updated 10MHz Bandwidth output power.	Peng Zhang

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1. Attestation of Test Results

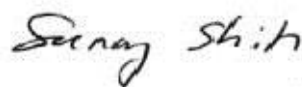
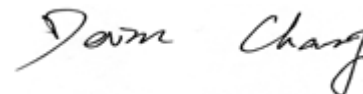
Applicant	Samsung Electronics Co., Ltd.			
DUT description	1x1 802.11abgn+BT4.0+Basic+EDR+HS,GSM1900,WCDMA1900, LTE B5+NFC			
Model	SM-C105S and SM-C105L			
Test device is	An identical prototype			
Device category	Portable			
Exposure category	General Population/Uncontrolled Exposure			
Date tested	8/6/2013 – 8/21/2013			
The highest reported SAR values	RF exposure condition	Licensed	DTS	UNII
	Head	0.312 W/kg	0.019 W/kg	0.023 W/kg
	Body-worn Accessory	0.458 W/kg	0.198 W/kg	0.287 W/kg
	Wireless Router (Hotspot)	0.480 W/kg	0.029 W/kg	N/A
	Simultaneous Transmission	0.655 W/kg	0.566 W/kg	0.655 W/kg
Applicable Standards	FCC 47 CFR Parts 1 & 2 Published RF Exposure KDB Procedures, and TCB workshop updates IEEE Std 1528-2003 and IEEE Std 1528a-2005			
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 Engineer
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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 1528-2003, 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 SAR Handsets Multi Xmitter and Ant 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 D05 SAR for LTE Devices v02r02
- 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 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	MY40000980	2/20/2014
Dielectronic Probe kit	SPEAG	DAK-3.5	1082	9/18/2013
Dielectronic Probe kit	SPEAG	DAK-3.5 Short	SM DAK 200 BA	N/A
Thermometer	Control Company	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	5/7/2014
Power Meter	HP	437B	3125U12345	7/29/2014
Power Sensor	HP	8481A	1926A27048	7/29/2014
Power Meter	HP	437B	3125U09248	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	AMETEK	XHR60-18	1318A00530	N/A
Thermometer	TRACEABLE	4242	122529163	9/19/2013
E-Field Probe	SPEAG	EX3DV4	3929	6/24/2014
E-Field Probe	SPEAG	EX3DV4	3773	4/26/2014
Data Acquisition Electronics	SPEAG	DAE4	1259	2/7/2014
Data Acquisition Electronics	SPEAG	DAE4	1359	2/8/2014
System Validation Dipole	SPEAG	D835V2	4d002	10/24/2014
System Validation Dipole	SPEAG	D1900V2	5d043	11/6/2013
System Validation Dipole	SPEAG	D2450V2	899	10/5/2013
System Validation Dipole	SPEAG	D5GHzV2	1138	10/9/2013

Others

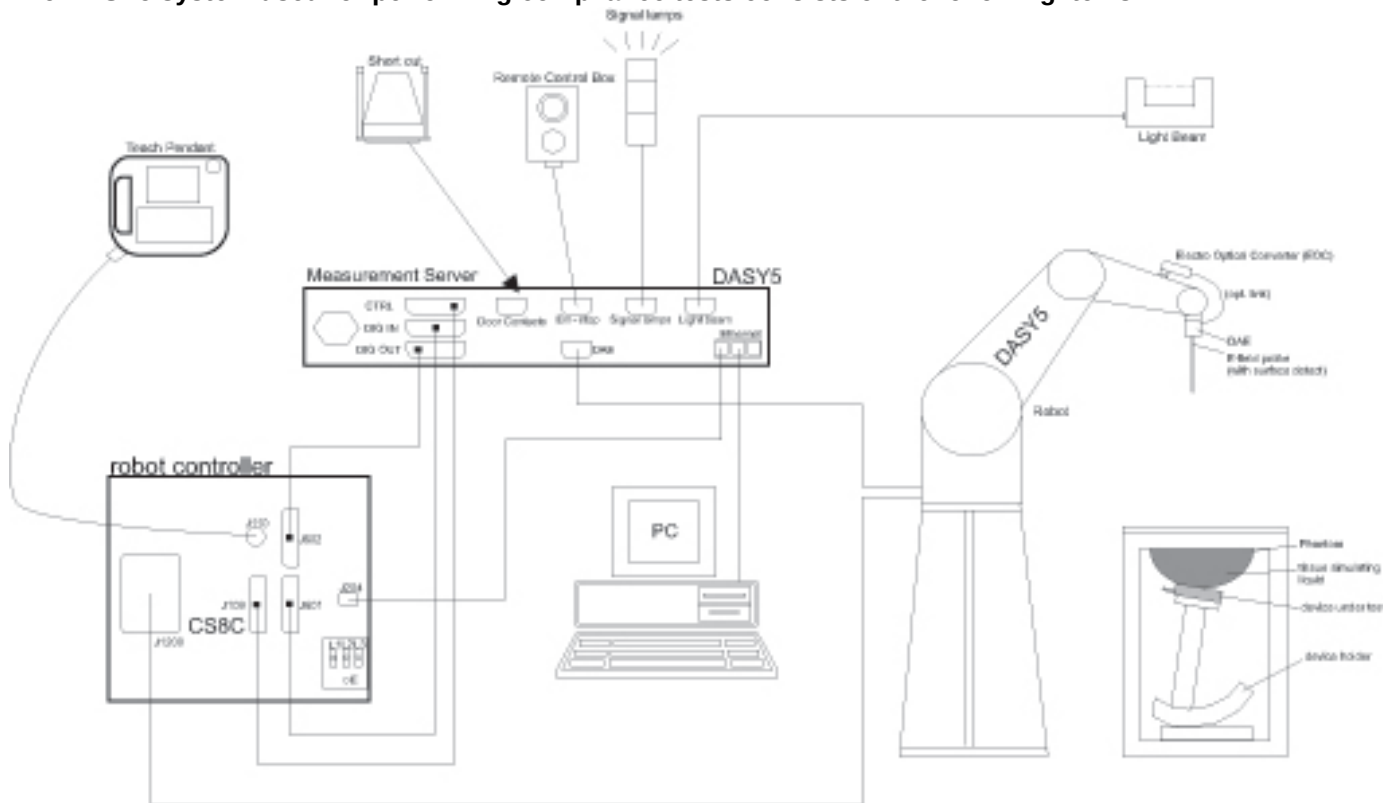
Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Base Station Simulator	Agilent	8960	MY48360200	3/20/2014
Base Station Simulator	R & S	CMU200	106301	7/3/2014
Base Station Simulator	R & S	CMW500	132910-cp	2/19/2014
Bluetooth Tester	R & S	CBT	100900-ac	7/4/2014
Power Meter	Agilent	N1912A	MY53040016	4/4/2014
Power Sensor	Agilent	N1921A	MY52020011	5/13/2014

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 1528-2003 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 <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

Operating Configuration(s)	Held to head, Body-worn (Voice call)
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 AP, FCC: Ch.1 ~ Ch.11) ☒ Mobile Hotspot (WiFi 5 GHz) (Mobile AP, FCC: Ch.149~165)
WiFi Direct	Wi-Fi Direct enabled devices transfer data directly between each other ☒ WiFi Direct (WiFi 2.4 GHz) (FCC: Ch.1 ~ Ch.11) ☒ WiFi Direct (WiFi 5 GHz) (FCC: Ch.149~165)
SV-LTE & SV-DO	Not Supported
RF Exposure Condition(s)	Head, Body-worn Accessory, Hotspot (wireless router) & WiFi Direct
Device dimension	Overall (Length x Width): 125 mm x 63 mm Overall Diagonal: 130 mm Display Diagonal: 109 mm
Accessory	Headset
Battery Options	☒ Standard – Lithium-ion battery, Rating 3.8 Vdc, 8.85 Wh ☐ Extended (large capacity)

7.2. Wireless Technologies

Wireless Technology and Frequency Bands	GSM: 1900 W-CDMA Band: II LTE Band 5 WiFi: 2.4 / 5 GHz Bluetooth: 2.4 GHz.
Mode	GSM - ☒ Voice (GMSK) - ☒ GPRS (GMSK) - ☒ EGPRS (8PSK) (Rx only) W-CDMA - ☒ UMTS Rel. 99 (Voice & Data) - ☒ HSDPA (Rel. 5) - ☒ HSUPA (Rel. 6) - ☐ DC-HSDPA (Rel.) - ☐ HSPA+ (Rel.) LTE: - ☒ QPSK - ☒ 16QAM WiFi 2.4GHz (802.11b/g/n) - ☒ 802.11b - ☒ 802.11g - ☒ 802.11n (20MHz) - ☐ 802.11n (40MHz) WiFi 5GHz - ☒ 802.11a - ☒ 802.11n (20MHz) - ☒ 802.11n (40MHz) Bluetooth Ver. 4.0 (LE)
Duty Cycle	GSM Voice: 12.5%; GPRS 1 Slot: 12.5%; 2 Slots: 25%, W-CDMA: 100% LTE: 100% WiFi 802.11a/b/g/n: 100% Bluetooth: 32.25% (DH1), 66.68% (DH3), 77.52% (DH5)
GPRS Multi-Slot Class	☐ Class 8 - One Up ☒ Class 10 - Two Up ☐ Class 12 - Four Up
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
DTM (Dual Transfer Mode)	Not Supported
VoIP (GPRS)	Not 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	1 Slot	2 Slot		
GSM1900	Voice	30.0		30.5			
	GPRS	30.0	27.0	30.5	27.5		
Upper limit (dB): 0.5 ~ -1.5				RF Output Power (dBm)			
RF Air interface	Mode	Target		Max. tune-up tolerance limit			
W-CDMA Band II	R99	23.5		24.0			
	HSDPA	22.5		23.0			
	HSUPA	23.5		24.0			
Upper limit (dB): 0.5 ~ -1.5				RF Output Power (dBm)			
RF Air interface	Mode	Target		Max. tune-up tolerance limit			
LTE Band 5	QPSK	23.5		24.0			
	16QAM	22.5		23.0			
Upper limit (dB): 0.5 ~ -1.5				RF Output Power (dBm)			
RF Air interface	Mode	Target		Max. tune-up tolerance limit			
WiFi 2.4 GHz	802.11b	17.0		17.5			
	802.11g	14.0		14.5			
	802.11n HT20	12.0		12.5			
RF Air interface	Mode	Target		Max. tune-up tolerance limit			
WiFi 5 GHz	802.11a	12.0		12.5			
	802.11n HT20	12.0		12.5			
	802.11n HT40	12.0		12.5			
Upper limit (dB): 0.5 ~ -1.5				RF Output Power (dBm)			
RF Air interface	Mode	Target		Max. tune-up tolerance limit			
Bluetooth	GFSK	9.0		9.5			

7.4. Simultaneous Transmission Condition

RF Exposure Condition	Capable Transmit Configurations
Head	1. GSM1900 Voice + WiFi 2.4/5 GHz 2. WCDMA Band II+ WiFi 2.4/5 GHz 3. LTE Band 5 + WiFi 2.4/5 GHz
Body-worn Accessory	1. GSM1900 Voice + WiFi 2.4/5 GHz 2. GSM1900 Voice + BT 3. WCDMA Band II + WiFi 2.4/5 GHz 4. WCDMA Band II + BT 5. LTE Band 5 + WiFi 2.4/5 GHz 6. LTE Band 5 + BT
Wireless Router (Hotspot) & WiFi Direct	1. GSM1900 (GPRS/EDGE) + WiFi 2.4/5.8 GHz 2. WCDMA Band II + WiFi 2.4/5.8 GHz 3. LTE Band 5 + WiFi 2.4/5.8 GHz
Notes: 1. WiFi 2.4 GHz and WiFi 5.8 GHz supports Hotspot. 2. WiFi 2.4 GHz and WiFi 5.8 GHz supports WiFi Direct. 3. GPRS and W-CDMA and LTE supports Hotspot. 4. WiFi 2.4 GHz Radio cannot transmit simultaneously with Bluetooth Radio. 5. WiFi 5 GHz Radio cannot transmit simultaneously with Bluetooth Radio.	

7.5. General LTE SAR Test and Reporting Considerations

Item	Description																																												
Frequency range, Channel Bandwidth, Numbers and Frequencies	Band 5																																												
	Tx: 824 to 849 MHz				Rx: 869 to 894 MHz																																								
	Band 5	Channel Bandwidth																																											
		20 MHz	15 MHz	10 MHz	5 MHz	3 MHz	1.4 MHz																																						
	Low			20450/829	20425/826.5																																								
	Mid			20525/836.5	20525/836.5																																								
	High			20600/844	20625/846.5																																								
LTE transmitter and antenna implementation	LTE has one TX/RX antennas. Refer to Section 17 for antenna locations																																												
Maximum power reduction (MPR)	Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3 <table><tr><th rowspan="2">Modulation</th><th colspan="6">Channel bandwidth / Transmission bandwidth (RB)</th><th rowspan="2">MPR (dB)</th></tr><tr><th>1.4 MHz</th><th>3.0 MHz</th><th>5 MHz</th><th>10 MHz</th><th>15 MHz</th><th>20 MHz</th></tr><tr><td>QPSK</td><td>> 5</td><td>> 4</td><td>> 8</td><td>> 12</td><td>> 16</td><td>> 18</td><td>≤ 1</td></tr><tr><td>16 QAM</td><td>≤ 5</td><td>≤ 4</td><td>≤ 8</td><td>≤ 12</td><td>≤ 16</td><td>≤ 18</td><td>≤ 1</td></tr><tr><td>16 QAM</td><td>> 5</td><td>> 4</td><td>> 8</td><td>> 12</td><td>> 16</td><td>> 18</td><td>≤ 2</td></tr></table> MPR Built-in by design A-MPR (additional MPR) was disabled during SAR testing							Modulation	Channel bandwidth / Transmission bandwidth (RB)						MPR (dB)	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1	16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1	16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2
Modulation	Channel bandwidth / Transmission bandwidth (RB)						MPR (dB)																																						
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz																																							
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1																																						
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1																																						
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2																																						
Power reduction	No																																												
Spectrum plots for RB configurations	A properly configured basestation simulator was used for the SAR and power measurements; therefore, spectrum plots for each RB allocation and offset configuration are not included in the SAR report.																																												

8. RF Exposure Conditions

Refer to Section 17 “Antenna Locations & Separation Distances” for the specific details of the antenna-to-antenna and antenna-to-edge(s) distances.

8.1. Head Exposure Conditions

For WWAN, LTE and WiFi

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

For WWAN and LTE

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

For WiFi

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

8.3. Hotspot Exposure Conditions

For WWAN and LTE

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	<25 mm	Yes	
Front	<25 mm	Yes	
Edge 1 (Right)	104 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 (Top)	11 mm	Yes	
Edge 3 (Left)	5 mm	Yes	
Edge 4 (Bottom)	3 mm	Yes	

8.4. Hotspot Exposure Conditions & WiFi Direct

For WiFi (2.4 GHz and 5.8 GHz only)

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	<25 mm	Yes	
Front	<25 mm	Yes	
Edge 1 (Right)	98 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 (Top)	5 mm	Yes	
Edge 3 (Left)	8 mm	Yes	
Edge 4 (Bottom)	53 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)
1900	512	1850.2	29.7
	661	1880.0	29.8
	810	1909.8	29.9

GPRS (GMSK) - Coding Scheme: CS1

Band	Ch No.	Freq. (MHz)	Avg Power (dBm)			
			1 time slot		2 time slots	
			Burst	Frame	Burst	Frame
1900	512	1850.2	29.8	20.7	27.3	21.3
	661	1880.0	29.9	20.8	27.4	21.4
	810	1909.8	29.9	20.9	27.4	21.3

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

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

Measured Results

Band	Mode	UL Ch No.	Freq. (MHz)	Avg Pwr (dBm)
W-CDMA Band II	Rel 99 (RMC, 12.2 kbps)	9262	1852.4	23.5
		9400	1880.0	23.8
		9538	1907.6	23.3

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
HSDPA Specific Settings	β_{hs}	4/15	24/15	30/15	30/15
	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 II	Subtest 1	9262	1852.4	22.5
		9400	1880.0	22.8
		9538	1907.6	22.1
	Subtest 2	9262	1852.4	21.5
		9400	1880.0	21.8
		9538	1907.6	21.3
	Subtest 3	9262	1852.4	20.6
		9400	1880.0	20.8
		9538	1907.6	20.2
	Subtest 4	9262	1852.4	20.6
		9400	1880.0	20.8
		9538	1907.6	20.3

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

HSPA (HSDPA & HSUPA)

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

	Mode	HSPA	HSPA	HSPA	HSPA	HSPA
	Subtest	1	2	3	4	5
WCDMA General Settings	Loopback Mode	Test Mode 1				
	Rel99 RMC	12.2kbps RMC				
	HSDPA FRC	H-Set1				
	HSUPA Test	HSUPA Loopback				
	Power Control Algorithm	Algorithm2				
	β_c	11/15	6/15	15/15	2/15	15/15
	β_d	15/15	15/15	9/15	15/15	15/15
	β_{ec}	209/225	12/15	30/15	2/15	24/15
	β_c/β_d	11/15	6/15	15/9	2/15	15/15
	β_{hs}	22/15	12/15	30/15	4/15	30/15
	β_{ed}	1309/225	94/75	47/15	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 II	Subtest 1	9262	1852.4	23.6
		9400	1880.0	23.8
		9538	1907.6	23.3
	Subtest 2	9262	1852.4	21.6
		9400	1880.0	21.8
		9538	1907.6	21.4
	Subtest 3	9262	1852.4	23.5
		9400	1880.0	23.7
		9538	1907.6	23.2
	Subtest 4	9262	1852.4	21.6
		9400	1880.0	21.9
		9538	1907.6	21.3
	Subtest 5	9262	1852.4	23.6
		9400	1880.0	23.7
		9538	1907.6	23.5

9.3. LTE Band

The following tests were conducted according to the test requirements outlined in section 6.2 of the 3GPP TS36.101 specification.

UE Power Class: 3 (23 +/- 2dBm). The allowed Maximum Power Reduction (MPR) for the maximum output power due to higher order modulation and transmit bandwidth configuration (resource blocks) is specified in Table 6.2.3-1 of the 3GPP TS36.101.

Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3

Modulation	Channel bandwidth / Transmission bandwidth (RB)						MPR (dB)
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2

The allowed A-MPR values specified below in Table 6.2.4-1 of 3GPP TS36.101 are in addition to the allowed MPR requirements. All the measurements below were performed with A-MPR disabled, by using Network Signalling Value of "NS_01".

Table 6.2.4-1: Additional Maximum Power Reduction (A-MPR)

Network Signalling value	Requirements (sub-clause)	E-UTRA Band	Channel bandwidth (MHz)	Resources Blocks (N_{RB})	A-MPR (dB)
NS_01	6.6.2.1.1	Table 5.5-1	1.4, 3, 5, 10, 15, 20	Table 5.6-1	NA
NS_03	6.6.2.2.1	2, 4, 10, 23, 25, 35, 36	3	>5	≤ 1
			5	>6	≤ 1
			10	>6	≤ 1
			15	>8	≤ 1
			20	>10	≤ 1
NS_04	6.6.2.2.2	41	5	>6	≤ 1
			10, 15, 20	See Table 6.2.4-4	
NS_05	6.6.3.3.1	1	10, 15, 20	≥ 50	≤ 1
NS_06	6.6.2.2.3	12, 13, 14, 17	1.4, 3, 5, 10	Table 5.6-1	n/a
NS_07	6.6.2.2.3 6.6.3.3.2	13	10	Table 6.2.4-2	Table 6.2.4-2
NS_08	6.6.3.3.3	19	10, 15	> 44	≤ 3
NS_09	6.6.3.3.4	21	10, 15	> 40	≤ 1
				> 55	≤ 2
NS_10		20	15, 20	Table 6.2.4-3	Table 6.2.4-3
NS_11	6.6.2.2.1	23 ¹	1.4, 3, 5, 10	Table 6.2.4-5	Table 6.2.4-5
..					
NS_32	-	-	-	-	-

Note 1: Applies to the lower block of Band 23, i.e. a carrier placed in the 2000-2010 MHz region.

LTE Band 5 Measured Results

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Avg Pwr (dBm)		
						829 MHz	836.5 MHz	844 MHz
LTE Band 5	10	QPSK	1	0	0	23.5	23.9	23.7
			1	25	0	23.4	23.7	23.7
			1	49	0	23.1	23.3	23.3
			25	0	1	22.4	22.2	22.2
			25	12	1	22.3	22.3	22.2
			25	25	1	22.2	22.3	22.1
			50	0	1	22.4	22.3	22.2
		16QAM	1	0	1	22.7	22.2	22.8
			1	25	1	22.7	22.1	22.4
			1	49	1	22.4	22.3	22.7
			25	0	2	21.2	21.0	21.1
			25	12	2	21.3	21.0	21.1
			25	25	2	21.1	20.9	20.9
			50	0	2	21.2	21.2	21.1
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Avg Pwr (dBm)		
						826.5 MHz	836.5 MHz	846.5 MHz
LTE Band 5	5	QPSK	1	0	0	23.7	23.9	23.8
			1	12	0	23.2	23.9	23.6
			1	24	0	23.4	23.6	23.3
			12	0	1	22.4	22.2	22.3
			12	6	1	22.4	22.2	22.2
			12	11	1	22.4	22.1	22.1
			25	0	1	22.4	22.2	22.2
		16QAM	1	0	1	22.2	22.3	22.8
			1	12	1	22.2	22.3	22.7
			1	24	1	22.3	22.2	22.4
			12	0	2	20.7	21.0	20.9
			12	6	2	20.7	20.9	20.9
			12	11	2	20.8	20.8	20.8
			25	0	2	21.0	21.0	21.1

9.4. WiFi (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 1/4 dB ≥ 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	Data Rate	Ch #	Freq. (MHz)	Avg Pwr (dBm)	SAR test (Yes/No)
2.4 (DTS)	802.11b	1 Mbps	1	2412	16.2	Yes
			6	2437	17.2	
			11	2462	16.6	
	802.11g	6 Mbps	1	2412	14.0	No
			6	2437	13.6	
			11	2462	14.1	
	802.11n (HT20)	6.5 Mbps	1	2412	11.8	No
			6	2437	12.4	
			11	2462	11.9	

Power measurements to determine worst-case data rates

Mode	Ch #	Freq. (MHz)	Data Rate	Avg Pwr (dBm)	SAR test (Yes/No)
802.11b	6	2437	1 Mbps	17.2	Yes
			2 Mbps	17.2	No
			5.5 Mbps	17.1	No
			11 Mbps	17.1	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 1/4 dB higher than that measured on the corresponding 802.11b channels.

9.5. WiFi (5 GHz Bands)

Required Test Channels per KDB 248227 D01

Mode		Band	GHz	Channel	"Default Test Channels"	
					802.11a	
802.11a	UNII (15.407)	5.2 GHz	5.180	36	√	
			5.200	40		*
			2.220	44		*
			5.240	48	√	
		5.3 GHz	5.260	52	√	
			5.280	56		*
			5.300	60		*
			5.320	64	√	
		5.5 GHz	5.500	100		
			5.520	104	√	
			5.540	108		*
			5.560	112		*
			5.580	116	√	
			5.600	120		*
			5.620	124	√	
			5.640	128		*
			5.660	132		*
			5.680	136	√	
			5.700	140		*
	DTS (15.247)	5.8 GHz	5.745	149	√	
			5.765	153		*
			5.785	157	√	
			5.805	161		*
			5.825	165	√	

√ = "default test channels"

* = possible 802.11a channels with maximum average output > 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	Data Rate	Ch #	Freq. (MHz)	Avg Pwr (dBm)	SAR test (Yes/No)
5.2 (UNII)	802.11a	6 Mbps	36	5180	12.1	Yes
			40	5200	12.1	
			44	5220	12.1	
			48	5240	12.0	
	802.11n (HT20)	6.5 Mbps	36	5180	11.9	No
			40	5200	12.0	
			48	5240	11.9	
	802.11n (HT40)	13 Mbps	38	5190	12.1	No
			46	5230	12.1	
5.3 (UNII)	802.11a	6 Mbps	52	5260	12.2	Yes
			56	5280	11.4	
			60	5300	11.7	
			64	5320	11.7	
	802.11n (HT20)	6.5 Mbps	52	5260	11.9	No
			60	5300	11.9	
			64	5320	11.8	
	802.11n (HT40)	13 Mbps	54	5270	12.1	No
			62	5310	12.1	
5.5 (UNII)	802.11a	6 Mbps	100	5500	12.0	Yes
			104	5520	12.3	
			108	5540	12.0	
			112	5560	12.2	
			116	5580	12.3	
			120	5600	12.4	
			124	5620	12.2	
			128	5640	12.0	
			132	5660	12.4	
			136	5680	12.3	
			140	5700	12.1	
	802.11n (HT20)	6.5 Mbps	100	5500	12.1	No
			116	5580	12.1	
			140	5700	12.3	
	802.11n (HT40)	13.5 Mbps	102	5510	12.2	No
			110	5550	12.2	
			134	5670	11.5	
5.8 (DTS)	802.11a	6 Mbps	149	5745	12.3	Yes
			153	5765	12.2	
			157	5785	12.1	
			161	5805	12.2	
			165	5825	12.1	
	802.11n (HT20)	6.5 Mbps	149	5745	12.1	No
			157	5785	12.1	
			161	5805	12.1	
	802.11n (HT40)	13.5 Mbps	151	5755	11.6	No
			159	5795	11.6	

Power measurements to determine worst-case data rates

Band	Mode	Ch #	Freq. (MHz)	Data Rate	Avg Pwr (dBm)	SAR test (Yes/No)
5.2 GHz (UNII)	802.11a	40	5200	6 Mbps	12.1	Yes
				9 Mbps	12.1	No
				12 Mbps	12.2	No
				18 Mbps	11.8	No
				24 Mbps	11.5	No
				36 Mbps	11.2	No
				48 Mbps	10.6	No
				54 Mbps	10.6	No
5.3 GHz (UNII)	802.11a	60	5300	6 Mbps	11.7	Yes
				9 Mbps	11.4	No
				12 Mbps	11.7	No
				18 Mbps	10.9	No
				24 Mbps	10.8	No
				36 Mbps	10.8	No
				48 Mbps	10.6	No
				54 Mbps	10.4	No
5.5 GHz (UNII)	802.11a	120	5600	6 Mbps	12.4	Yes
				9 Mbps	12.3	No
				12 Mbps	12.4	No
				18 Mbps	11.9	No
				24 Mbps	11.6	No
				36 Mbps	11.6	No
				48 Mbps	11.4	No
				54 Mbps	11.2	No
5.8 GHz (DTS)	802.11a	157	5785	6 Mbps	12.1	Yes
				9 Mbps	11.9	No
				12 Mbps	12.1	No
				18 Mbps	11.5	No
				24 Mbps	11.4	No
				36 Mbps	11.2	No
				48 Mbps	10.9	No
				54 Mbps	10.7	No

9.6. Bluetooth

Band (GHz)	Mode	Ch #	Freq. (MHz)	Conducted Avg Power	
				(dBm)	(mW)
2.4	V3.0 + EDR, GFSK	0	2402	9.0	7.94
		39	2441	9.0	7.94
		78	2480	7.5	5.62
	V3.0 + EDR, $\pi/4$ DQPSK	0	2402	6.0	3.98
		39	2441	5.9	3.89
		78	2480	4.3	2.69
	V3.0 + EDR, 8-DPSK	0	2402	6.2	4.17
		39	2441	6.1	4.07
		78	2480	4.6	2.88
	V4.0 LE, GFSK	0	2402	5.7	3.72
		19	2440	5.9	3.89
		39	2480	4.4	2.75

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

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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

MSL/HSL750 (Body and Head liquids for 700 – 800 MHz)

Item	Head Tissue Simulation Liquids HSL750 Muscle (body) Tissue Simulation Liquids MSL750
Type No	SL AAH 075
Manufacturer	SPEAG
The item is composed of the following ingredients:	
H ² O	Water, 35 – 58%
Sucrose	Sugar, white, refined, 40-60%
NaCl	Sodium Chloride, 0-6%
Hydroxyethyl-cellulose	Medium Viscosity (CAS# 9004-62-0), <0.3%
Preventol-D7	Preservative: aqueous preparation, (CAS# 55965-84-9), containing 5-chloro-2-methyl-3(2H)-isothiazolone and 2-methyl-3(2H)-isothiazolone, 0.1-0.7%

MSL/HSL1750 (Body and Head liquids for 1700 – 1800 MHz)

Item	Head Tissue Simulation Liquids HSL1750 Muscle (body) Tissue Simulation Liquids MSL1750
Type No	SL AAM 175
Manufacturer	SPEAG
-The item is composed of the following ingredients:	
H ² O	Water, 52 – 75%
C8H18O3	Diethylene glycol monobutyl ether (DGBE), 25-48%
NaCl	Sodium Chloride, <1.0%

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 Room 1

	Freq. (MHz)		Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)
8/6/2013	Head 2450	e'	37.8900	Relative Permittivity (ε _r):	37.89	39.20	-3.34	5
		e"	13.4700	Conductivity (σ):	1.83	1.80	1.94	5
	Head 2410	e'	38.0600	Relative Permittivity (ε _r):	38.06	39.28	-3.10	5
		e"	13.3700	Conductivity (σ):	1.79	1.76	1.77	5
	Head 2475	e'	37.8000	Relative Permittivity (ε _r):	37.80	39.17	-3.49	5
		e"	13.5300	Conductivity (σ):	1.86	1.83	1.91	5
8/8/2013	Body 2450	e'	52.2200	Relative Permittivity (ε _r):	52.22	52.70	-0.91	5
		e"	14.0800	Conductivity (σ):	1.92	1.95	-1.64	5
	Body 2410	e'	52.3700	Relative Permittivity (ε _r):	52.37	52.76	-0.74	5
		e"	13.9300	Conductivity (σ):	1.87	1.91	-2.14	5
	Body 2475	e'	52.1800	Relative Permittivity (ε _r):	52.18	52.67	-0.93	5
		e"	14.1800	Conductivity (σ):	1.95	1.99	-1.70	5
8/9/2013	Head 5180	e'	37.5300	Relative Permittivity (ε _r):	37.53	36.01	4.21	5
		e"	15.3700	Conductivity (σ):	4.43	4.63	-4.40	5
	Head 5200	e'	37.5300	Relative Permittivity (ε _r):	37.53	35.99	4.28	5
		e"	15.3900	Conductivity (σ):	4.45	4.65	-4.33	5
	Head 5600	e'	36.9900	Relative Permittivity (ε _r):	36.99	35.53	4.10	5
		e"	15.5800	Conductivity (σ):	4.85	5.06	-4.13	5
	Head 5800	e'	36.6900	Relative Permittivity (ε _r):	36.69	35.30	3.94	5
		e"	15.6400	Conductivity (σ):	5.04	5.27	-4.29	5
	Head 5825	e'	36.6100	Relative Permittivity (ε _r):	36.61	35.30	3.71	5
		e"	15.7100	Conductivity (σ):	5.09	5.27	-3.45	5
8/14/2013	Body 5180	e'	49.3200	Relative Permittivity (ε _r):	49.32	49.05	0.56	5
		e"	17.6000	Conductivity (σ):	5.07	5.27	-3.84	5
	Body 5200	e'	49.2800	Relative Permittivity (ε _r):	49.28	49.02	0.53	5
		e"	17.6400	Conductivity (σ):	5.10	5.29	-3.67	5
	Body 5600	e'	48.5200	Relative Permittivity (ε _r):	48.52	48.48	0.09	5
		e"	18.0600	Conductivity (σ):	5.62	5.76	-2.39	5
	Body 5800	e'	48.3700	Relative Permittivity (ε _r):	48.37	48.20	0.35	5
		e"	18.3200	Conductivity (σ):	5.91	6.00	-1.53	5
Body 5825	e'	48.1900	Relative Permittivity (ε _r):	48.19	48.20	-0.02	5	
	e"	18.3000	Conductivity (σ):	5.93	6.00	-1.21	5	
8/14/2013	Head 1900	e'	39.2400	Relative Permittivity (ε _r):	39.24	40.00	-1.90	5
		e"	13.4800	Conductivity (σ):	1.42	1.40	1.72	5
	Head 1850	e'	39.5000	Relative Permittivity (ε _r):	39.50	40.00	-1.25	5
		e"	13.3300	Conductivity (σ):	1.37	1.40	-2.06	5
	Head 1910	e'	39.1900	Relative Permittivity (ε _r):	39.19	40.00	-2.03	5
e"		13.5100	Conductivity (σ):	1.43	1.40	2.48	5	

Tissue Dielectric Parameter Check Results (continued)

SAR Room 1

	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit $\pm$ (%)
8/14/2013	Body 1900	e'	52.5100	Relative Permittivity (ϵ_r):	52.51	53.30	-1.48	5
		e"	14.2500	Conductivity (σ):	1.51	1.52	-0.96	5
	Body 1850	e'	52.6900	Relative Permittivity (ϵ_r):	52.69	53.30	-1.14	5
		e"	14.1100	Conductivity (σ):	1.45	1.52	-4.51	5
	Body 1910	e'	52.4800	Relative Permittivity (ϵ_r):	52.48	53.30	-1.54	5
		e"	14.2800	Conductivity (σ):	1.52	1.52	-0.23	5
8/19/2013	Body 835	e'	53.7000	Relative Permittivity (ϵ_r):	53.70	55.20	-2.72	5
		e"	21.7600	Conductivity (σ):	1.01	0.97	4.15	5
	Body 820	e'	53.8500	Relative Permittivity (ϵ_r):	53.85	55.28	-2.58	5
		e"	21.8600	Conductivity (σ):	1.00	0.97	2.92	5
	Body 850	e'	53.5700	Relative Permittivity (ϵ_r):	53.57	55.16	-2.88	5
		e"	21.7000	Conductivity (σ):	1.03	0.99	3.90	5

SAR Room 2

	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit $\pm$ (%)
8/17/2013	Head 835	e'	40.8500	Relative Permittivity (ϵ_r):	40.85	41.50	-1.57	5
		e"	19.4000	Conductivity (σ):	0.90	0.90	0.08	5
	Head 820	e'	41.0400	Relative Permittivity (ϵ_r):	41.04	41.60	-1.35	5
		e"	19.4400	Conductivity (σ):	0.89	0.90	-1.35	5
	Head 850	e'	40.6700	Relative Permittivity (ϵ_r):	40.67	41.50	-2.00	5
		e"	19.3700	Conductivity (σ):	0.92	0.92	0.05	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 ± 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 ± 0.5 cm for SAR measurements ≤ 3 GHz and ≥ 10.0 cm ± 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	10/24/2013	835	1g	9.58	9.48
				10g	6.28	6.26
D1900V2	5d043	11/6/2012	1900	1g	39.9	40.9
				10g	20.9	21.6
D2450V2	899	10/5/2012	2450	1g	53.6	51.7
				10g	25.0	24.3
D5GHzV2	1138	10/9/2012	5200	1g	79.5	73.2
				10g	22.8	20.4
			5500	1g	83.6	77.9
				10g	23.8	21.7
			5800	1g	78.7	72.8
				10g	22.4	20.1

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 1

Date Tested	System Dipole		T.S. Liquid		Measured Results			Target (Ref. Value)	Delta ±10 %	Est./Zoom Ratio	Plot No
	Type	Serial #			Area Scan	Zoom Scan	Normalize to 1 W				
8/6/2013	D2450V2	899	Head	1g	5.69	5.63	56.30	53.60	5.04	1.05	
				10g	2.48	2.57	25.70	25.00	2.80		
8/8/2013	D2450V2	899	Body	1g	5.40	5.55	55.50	51.70	7.35	-2.78	1,2
				10g	2.38	2.59	25.90	24.30	6.58		
8/9/2013	D5GHzV2 (5.2)	1138	Head	1g	7.85	8.47	84.70	79.50	6.54	-7.90	3,4
				10g	2.22	2.44	24.40	22.80	7.02		5,6
	1g			8.16	8.82	88.20	83.60	5.50	-8.09		
	10g			2.25	2.49	24.90	23.80	4.62			
	1g			8.14	8.82	88.20	83.60	5.50	-8.35		
	10g			2.27	2.52	25.20	23.80	5.88			
	1g			7.77	8.40	84.00	78.70	6.73	-8.11	7,8	
	10g			2.15	2.39	23.90	22.40	6.70			
8/12/2013	D5GHzV2 (5.2)	1138	Body	1g	6.99	7.60	76.00	73.20	3.83	-8.73	
				10g	2.01	2.17	21.70	20.40	6.37		
	1g			7.45	8.11	81.10	77.90	4.11	-8.86		
	10g			2.11	2.31	23.10	21.70	6.45			
	1g			7.78	8.39	83.90	77.90	7.70	-7.84	9,10	
	10g			2.16	2.35	23.50	21.70	8.29			
	1g			6.83	7.46	74.60	78.20	-4.60	-9.22		
	10g			1.90	2.09	20.90	20.10	3.98			
8/14/2013	D1900V2	5d043	Head	1g	4.22	4.12	41.20	39.90	3.26	2.37	
				10g	2.17	2.13	21.30	20.90	1.91		
8/14/2013	D1900V2	5d043	Body	1g	3.83	3.85	38.50	40.90	-5.87	-0.52	11,12
				10g	1.98	2.04	20.40	21.60	-5.56		
8/19/2013	D835V2	4d002	Body	1g	1.00	0.98	9.77	9.48	3.06	2.30	13,14
				10g	0.67	0.64	6.42	6.26	2.56		

SAR Room 2

Date Tested	System Dipole		T.S. Liquid	Measured Results			Target (Ref. Value)	Delta $\pm 10\%$	Est./Zoom Ratio	Plot No.
	Type	Serial #		Area Scan	Zoom Scan	Normalize to 1 W				
8/17/2013	D835V2	4d002	Head	1g	0.96	0.94	9.40	9.58	-1.88	2.19
				10g	0.65	0.62	6.15	6.28	-2.07	

12. SAR Test Results

12.1. GSM1900

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	Voice	N/A	661	1880.0	30.5	29.8	0.129	0.152	
Head	Left Tilt	Voice	N/A	661	1880.0	30.5	29.8	0.098	0.115	
Head	Right Touch	Voice	N/A	661	1880.0	30.5	29.8	0.144	0.169	1
Head	Right Tilt	Voice	N/A	661	1880.0	30.5	29.8	0.083	0.098	
Body	Rear	Voice	10	661	1880.0	30.5	29.8	0.113	0.133	
Body	Front	Voice	10	661	1880.0	30.5	29.8	0.128	0.150	2
Hotspot	Rear	GPRS 2 Slots	10	661	1880.0	27.5	27.4	0.166	0.170	
Hotspot	Front	GPRS 2 Slots	10	661	1880.0	27.5	27.4	0.200	0.205	
Hotspot	Edge 2	GPRS 2 Slots	10	661	1880.0	27.5	27.4	0.070	0.072	
Hotspot	Edge 3	GPRS 2 Slots	10	661	1880.0	27.5	27.4	0.358	0.366	3
Hotspot	Edge 4	GPRS 2 Slots	10	661	1880.0	27.5	27.4	0.176	0.180	

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. W-CDMA Band II

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	Rel 99 RMC	N/A	9400	1880.0	24.0	23.8	0.204	0.214	
Head	Left Tilt	Rel 99 RMC	N/A	9400	1880.0	24.0	23.8	0.155	0.162	
Head	Right Touch	Rel 99 RMC	N/A	9400	1880.0	24.0	23.8	0.236	0.247	4
Head	Right Tilt	Rel 99 RMC	N/A	9400	1880.0	24.0	23.8	0.151	0.158	
Body & Hotspot	Rear	Rel 99 RMC	10	9400	1880.0	24.0	23.8	0.351	0.368	5
Body & Hotspot	Front	Rel 99 RMC	10	9400	1880.0	24.0	23.8	0.246	0.258	
Hotspot	Edge 2	Rel 99 RMC	10	9400	1880.0	24.0	23.8	0.096	0.101	
Hotspot	Edge 3	Rel 99 RMC	10	9400	1880.0	24.0	23.8	0.458	0.480	6
Hotspot	Edge 4	Rel 99 RMC	10	9400	1880.0	24.0	23.8	0.233	0.244	

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. LTE Band 5

RF Exposure Conditions	Test Position	Mode	Dist. (mm)	Ch #.	Freq. (MHz)	RB Allocation	RB Offset	Power (dBm)		1-g SAR (W/kg)		Plot No.
								Tune-up limit	Meas.	Meas.	Scaled	
Head	Left Touch	QPSK	N/A	20525	836.5	1	0	24.0	23.9	0.261	0.267	
				20450	829.0	25	0	23.0	22.4	0.137	0.157	
Head	Left Tilt	QPSK	N/A	20525	836.5	1	0	24.0	23.9	0.234	0.239	
				20450	829.0	25	0	23.0	22.4	0.119	0.137	
Head	Right Touch	QPSK	N/A	20525	836.5	1	0	24.0	23.9	0.305	0.312	7
				20450	829.0	25	0	23.0	22.4	0.136	0.156	
Head	Right Tilt	QPSK	N/A	20525	836.5	1	0	24.0	23.9	0.196	0.201	
				20450	829.0	25	0	23.0	22.4	0.120	0.138	
Body & Hotspot	Rear	QPSK	10	20525	836.5	1	0	24.0	23.9	0.301	0.308	
				20450	829.0	25	0	23.0	22.4	0.189	0.217	
Body & Hotspot	Front	QPSK	10	20525	836.5	1	0	24.0	23.9	0.448	0.458	8
				20450	829.0	25	0	23.0	22.4	0.287	0.330	
Hotspot	Edge 2	QPSK	10	20525	836.5	1	0	24.0	23.9	0.371	0.380	
				20450	829.0	25	0	23.0	22.4	0.223	0.256	
Hotspot	Edge 3	QPSK	10	20525	836.5	1	0	24.0	23.9	0.230	0.235	
				20450	829.0	25	0	23.0	22.4	0.120	0.138	
Hotspot	Edge 4	QPSK	10	20525	836.5	1	0	24.0	23.9	0.314	0.321	
				20450	829.0	25	0	23.0	22.4	0.213	0.245	

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
- Per KDB 941225 D05 SAR for LTE Devices v02, SAR test reduction is applied using the following criteria:
 - Testing for Low and High Channel is performed at the highest output power level for 1RB, and 50% RB configuration for that channel.
 - Testing for 100% RB configuration is performed at the highest output power level for 100% RB configuration across the Low, Mid and High Channel when the highest reported SAR for 1 RB and 50% RB are ≥ 0.8 W/kg. Testing for the remaining required channels is not needed because the reported SAR for 100% RB Allocation < 1.45 W/kg.
 - Testing for 16-QAM modulation is not required because the reported SAR for QPSK is < 1.45 W/Kg and its output power is not more than 0.5 dB higher than that of QPSK.
 - Testing for the other channel bandwidths is not required because the reported SAR for the highest channel bandwidth is < 1.45 W/Kg and its output power is not more than 0.5 dB higher than that of the highest channel bandwidth.
- 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 Band)

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	N/A	6	2437	17.5	17.2	0.018	0.019	9
Head	Left Tilt	802.11b	N/A	6	2437	17.5	17.2	0.010	0.010	
Head	Right Touch	802.11b	N/A	6	2437	17.5	17.2	0.016	0.017	
Head	Right Tilt	802.11b	N/A	6	2437	17.5	17.2	0.016	0.017	
Body & Hotspot	Rear	802.11b	10	6	2437	17.5	17.2	0.024	0.026	
Body & Hotspot	Front	802.11b	10	6	2437	17.5	17.2	0.009	0.010	
Hotspot	Edge 2	802.11b	10	6	2437	17.5	17.2	0.027	0.029	10
Hotspot	Edge 3	802.11b	10	6	2437	17.5	17.2	0.009	0.010	
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	802.11a	N/A	149	5745	12.5	12.3	<0.001	<0.001	
Head	Left Tilt	802.11a	N/A	149	5745	12.5	12.3	<0.001	<0.001	
Head	Right Touch	802.11a	N/A	149	5745	12.5	12.3	0.012	0.013	
Head	Right Tilt	802.11a	N/A	149	5745	12.5	12.3	<0.001	<0.001	
Body	Rear	802.11a	10	149	5745	12.5	12.3	0.189	0.198	11
Body	Front	802.11a	10	149	5745	12.5	12.3	0.067	0.070	
Hotspot	Edge 2	802.11a	10	149	5745	12.5	12.3	0.101	0.106	
Hotspot	Edge 3	802.11a	10	149	5745	12.5	12.3	0.016	0.017	

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. Wi-Fi (UNII Band)

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	802.11a	N/A	36	5180	12.5	12.1	0.012	0.013	
				52	5260	12.5	12.2	<0.001	<0.001	
				120	5600	12.5	12.4	<0.001	<0.001	
Head	Left Tilt	802.11a	N/A	36	5180	12.5	12.1	<0.001	<0.001	
				52	5260	12.5	12.2	<0.001	<0.001	
				120	5600	12.5	12.4	<0.001	<0.001	
Head	Right Touch	802.11a	N/A	36	5180	12.5	12.1	0.020	0.022	
				52	5260	12.5	12.2	0.021	0.023	12
				120	5600	12.5	12.4	0.020	0.020	
Head	Right Tilt	802.11a	N/A	36	5180	12.5	12.1	<0.001	<0.001	
				52	5260	12.5	12.2	<0.001	<0.001	
				120	5600	12.5	12.4	<0.001	<0.001	
Body	Rear	802.11a	10	36	5180	12.5	12.1	0.262	0.287	13
				52	5260	12.5	12.2	0.231	0.248	
				120	5600	12.5	12.4	0.238	0.244	
Body	Front	802.11a	10	36	5180	12.5	12.1	0.022	0.024	
				52	5260	12.5	12.2	0.037	0.040	
				120	5600	12.5	12.4	0.059	0.060	

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.

12.6. Bluetooth

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	
Body	Rear	GFSK	10	39	2441	9.5	9.0	<0.001	<0.001	
Body	Front	GFSK	10	39	2441	9.5	9.0	<0.001	<0.001	14

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.

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/WiFi Direct (W/kg)
850	LTE Band 5	<0.8 W/kg	<0.8 W/kg	<0.8 W/kg
1900	GSM 1900	<0.8 W/kg	<0.8 W/kg	<0.8 W/kg
	WCDMA Band II	<0.8 W/kg	<0.8 W/kg	<0.8 W/kg
2400	WiFi 802.11b/g/n	<0.8 W/kg	<0.8 W/kg	<0.8 W/kg
5000	WiFi 802.11a/n	<0.8 W/kg	<0.8 W/kg	<0.8 W/kg

13.2. Repeated Measurement Results

Head Exposure Condition

Not Applicable.

Body-worn Accessory Exposure Condition

Not Applicable.

Hotspot Mode Exposure Conditions

Not Applicable.

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 GSM1900 & WiFi & BT

RF Exposure conditions	Test Position	Simultaneous Transmission Scenario				Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
		GSM 1900	WiFi DTS Band	WiFi UNII Band	Bluetooth		
Head	Left Touch	0.152	0.019			0.171	No
		0.152		0.013		0.165	No
	Left Tilt	0.115	0.010			0.125	No
		0.115		0.001		0.116	No
	Right Touch	0.169	0.017			0.186	No
		0.169		0.023		0.192	No
	Right Tilt	0.098	0.017			0.115	No
		0.098		0.001		0.099	No
Body-worn Accessory & Hotspot	Rear	0.170	0.198			0.368	No
		0.170		0.287		0.457	No
		0.170			0.001	0.171	No
	Front	0.205	0.070			0.275	No
		0.205		0.060		0.265	No
		0.205			0.001	0.206	No
Hotspot	Edge 1	0	0			0	No
	Edge 2	0.072	0.106			0.178	No
	Edge 3	0.366	0.017			0.383	No
	Edge 4	0.180	0			0.180	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 W-CDMA Band II & WiFi & BT

RF Exposure conditions	Test Position	Simultaneous Transmission Scenario				Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
		W-CDMA Band II	WiFi DTS Band	WiFi UNII Band	Bluetooth		
Head	Left Touch	0.214	0.019			0.233	No
		0.214		0.013		0.227	No
	Left Tilt	0.162	0.010			0.172	No
		0.162		0.001		0.163	No
	Right Touch	0.247	0.017			0.264	No
		0.247		0.023		0.270	No
	Right Tilt	0.158	0.017			0.175	No
		0.158		0.001		0.159	No
Body-worn Accessory & Hotspot	Rear	0.368	0.198			0.566	No
		0.368		0.287		0.655	No
		0.368			0.001	0.369	No
	Front	0.258	0.070			0.328	No
		0.258		0.060		0.318	No
		0.258			0.001	0.259	No
Hotspot	Edge 1	0	0			0	No
	Edge 2	0.101	0.106			0.207	No
	Edge 3	0.480	0.017			0.497	No
	Edge 4	0.244	0			0.244	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 LTE Band 5 & WiFi & BT

RF Exposure conditions	Test Position	Simultaneous Transmission Scenario				Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
		LTE Band 5	WiFi DTS Band	WiFi UNII Band	Bluetooth		
Head	Left Touch	0.267	0.019			0.286	No
		0.267		0.013		0.280	No
	Left Tilt	0.239	0.010			0.249	No
		0.239		0.001		0.240	No
	Right Touch	0.312	0.017			0.329	No
		0.312		0.023		0.335	No
	Right Tilt	0.201	0.017			0.218	No
		0.308		0.001		0.309	No
Body-worn Accessory & Hotspot	Rear	0.308	0.198			0.506	No
		0.308		0.287		0.595	No
		0.308			0.001	0.309	No
	Front	0.458	0.070			0.528	No
		0.458		0.060		0.518	No
		0.458			0.001	0.459	No
Hotspot	Edge 1	0	0			0	No
	Edge 2	0.380	0.106			0.486	No
	Edge 3	0.235	0.017			0.252	No
	Edge 4	0.321	0			0.321	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. System Performance Check Plots**
- 15.2. Highest SAR Test Plots**
- 15.3. Calibration Certificate for E-Field Probe EX3DV4 - SN 3929**
- 15.4. Calibration Certificate for E-Field Probe EX3DV4 - SN 3773**
- 15.5. Calibration Certificate for D850V3 - SN 4d002**
- 15.6. Calibration Certificate for D1900V2 - SN 5d163**
- 15.7. Calibration Certificate for D2450V2 - SN 889**
- 15.8. Calibration Certificate for D5GHzV2 - SN 1138**