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

SAR EVALUATION REPORT

For
GSM / W-CDMA / LTE Phone + Bluetooth & WLAN (2.4GHz)

Model: LGL31L, LG-L31L, L31L
FCC ID: ZNFL31L

Report Number: 13U16673-5A
Issue Date: 1/28/2014

Prepared for
LG ELECTRONICS MOBILECOMM U.S.A., INC.
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ENGLEWOOD CLIFFS, NJ 07632

Prepared by
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	1/23/2014	Initial Issue	--
A	1/28/2014	Made the following modifications: 1. Sec. 1.: Updated highest reported SAR values 2. Sec. 7.4.: Updated table 3. Sec. 8.3.: Updated table to reflect KDB 648474 D04 4. Sec. 12., 14.: Additional SAR testing was performed for Wi-Fi Direct	Kenneth Mak

Table of Contents

1. Attestation of Test Results

Applicant	LG ELECTRONICS MOBILECOMM U.S.A., INC.			
DUT description	GSM / W-CDMA / LTE Phone + Bluetooth & WLAN (2.4GHz)			
Model	LGL31L, LG-L31L, L31L			
Test device is	An identical prototype			
Device category	Portable			
Exposure category	General Population/Uncontrolled Exposure			
Date tested	12/13/2013 – 12/18/2013, 01/23/2014 – 01/24/2014			
The highest reported SAR values	RF exposure conditions	Licensed	DTS	UNII
	Head	0.499 W/kg	0.055 W/kg (2.4GHz)	N/A
	Body-worn Accessory	0.569 W/kg	0.077 W/kg (2.4GHz)	N/A
	Wireless Router (Hotspot)	N/A	N/A	N/A
	Wi-Fi Direct	N/A	0.077 W/kg (2.4GHz)	N/A
	Simultaneous Transmission	0.646 W/kg	0.646 W/kg	N/A
Applicable Standards	FCC 47 CFR Parts 1 & 2 Published RF Exposure KDB Procedures, and TCB workshop updates IEEE Std 1528-2013			
Test Results	Pass			

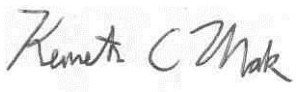
UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement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

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

Approved & Released By:

Bobby Bayani
WiSE Engineer
UL Verification Services Inc.

Prepared By:



Kenneth Mak
WiSE Laboratory Engineer
UL Verification Services Inc.

2. Test Methodology

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

- 447498 D01 General RF Exposure Guidance v05r01
- 648474 D04 Handset SAR v01r01
- 941225 D01 SAR test for 3G devices v02
- 941225 D02 HSPA and 1x Advanced v02r02
- 941225 D03 SAR Test Reduction GSM GPRS EDGE v01
- 941225 D04 SAR for GSM E GPRS Dual Xfer Mode v01
- 941225 D05 SAR for LTE Devices v02r02
- 248227 D01 SAR Meas for 802 11abg v01r02
- 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r01
- 865664 D02 SAR Reporting v01r01
- 690783 D01 SAR Listings on Grants v01r03

3. Facilities and Accreditation

The test sites and measurement facilities used to collect data are located at 47173 & 47266 Benicia Street, Fremont, California, USA.

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

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

4. Calibration and Uncertainty

4.1. Measuring Instrument Calibration

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

Tissue Dielectric Properties

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

System Performance Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Synthesized Signal Generator	HP	8665B	3744A01084	5/7/2014
Power Meter	HP	437B	3125U12345	7/29/2014
Power Sensor	HP	8481A	1926A27048	7/29/2014
Power Meter	HP	437B	3125U11364	8/26/2014
Power Sensor	HP	8481A	2702A76223	9/17/2014
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1620606	N/A
Directional coupler	Werlatone	C8060-102	2141	N/A
DC Power Supply	Ametek	XT 20-3	1318A00530	N/A
E-Field Probe	SPEAG	EX3DV4	3749	1/15/2014
Data Acquisition Electronics	SPEAG	DAE4	1239	4/9/2014
E-Field Probe	SPEAG	EX3DV4	3686	3/11/2014
Data Acquisition Electronics	SPEAG	DAE4	1360	2/7/2014
E-Field Probe	SPEAG	EX3DV4	3885	9/18/2014
Data Acquisition Electronics	SPEAG	DAE4	1343	7/24/2014
E-Field Probe	SPEAG	EX3DV4	3902	7/12/2014
Data Acquisition Electronics	SPEAG	DAE4	1377	7/15/2014
System Validation Dipole	SPEAG	D750V3	1071	11/15/2014
System Validation Dipole	SPEAG	D835V2	4d002	11/15/2014
System Validation Dipole	SPEAG	D1750V2	1077	9/12/2014
System Validation Dipole	SPEAG	D1900V2	5d043	11/12/2014
System Validation Dipole	SPEAG	D2450V2	748	2/11/2014
System Validation Dipole	SPEAG	D2450V2	899	9/10/2014

Others

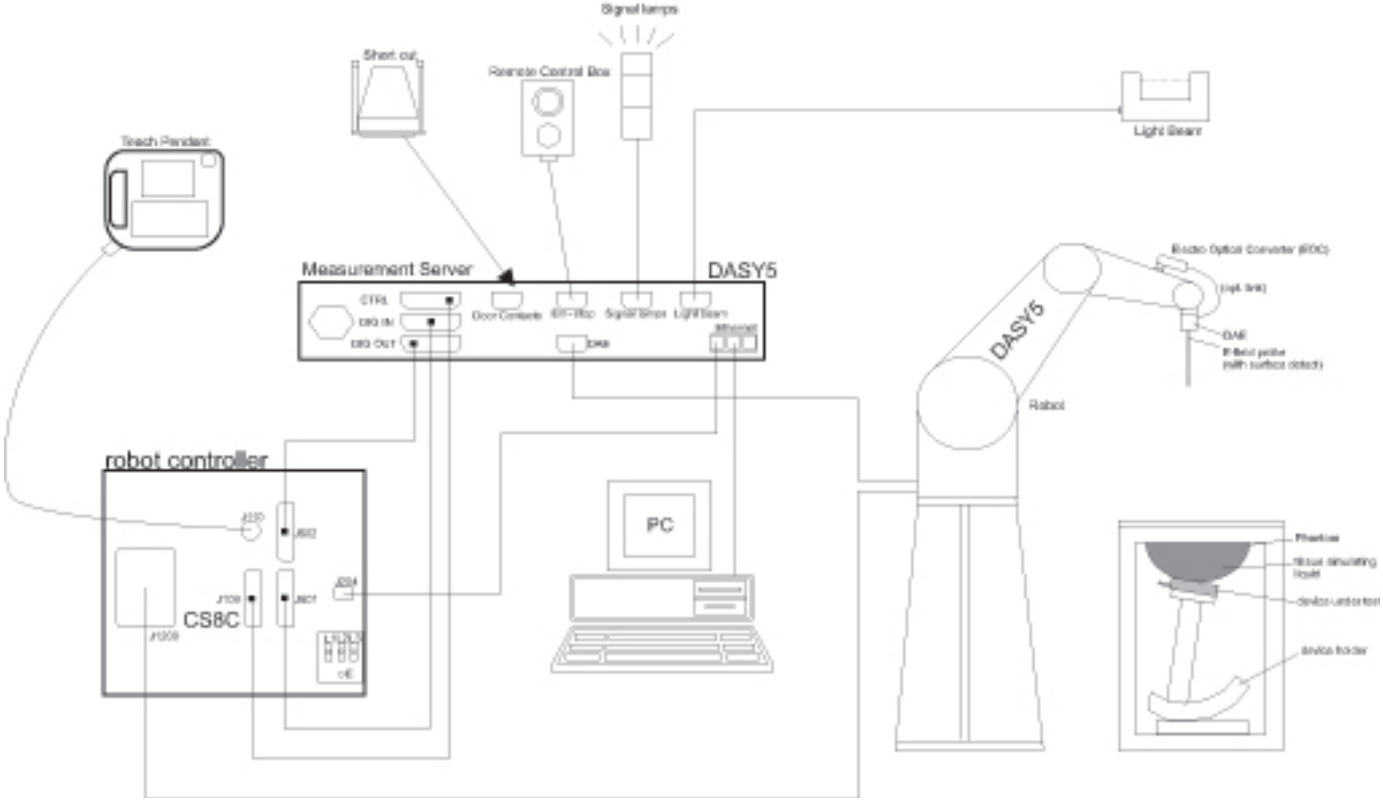
Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Power Meter	Agilent	N1912A	MY53040016	4/4/2014
Power Sensor	Agilent	N1921A	MY52020011	5/13/2014
Base Station Simulator	R & S	CMW500	132909	2/20/2014

4.2. Measurement Uncertainty

Per KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r01 Section 2.8.1., when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg, the extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval.

5. Measurement System Description and Setup

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



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

6. SAR Measurement Procedure

6.1. Normal SAR Measurement Procedure

Step 1: Power Reference Measurement

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

Step 2: Area Scan

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

Area Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	½·δ·ln(2) ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{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 ≤ 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 v01 (Draft)

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

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

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

Step 4: Power drift measurement

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

Step 5: Z-Scan (FCC only)

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

6.2. Volume Scan Procedures

Step 1: Repeat Step 1-4 in Section 6.1

Step 2: Volume Scan
Volume Scans are used to assess peak SAR and averaged SAR measurements in largely extended 3-dimensional volumes within any phantom. This measurement does not need any previous area scan. The grid can be anchored to a user specific point or to the current probe location.

Step 3: Power drift measurement
The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

7. Device Under Test

7.1. General Information

Operating Configuration(s)	Held to head, Body-worn (Voice call)
Mobile Hotspot	Wi-Fi Hotspot mode permits the device to share its cellular data connection with other Wi-Fi-enabled devices. ☐ Mobile Hotspot (Wi-Fi 2.4 GHz) ☐ Mobile Hotspot (Wi-Fi 5 GHz)
Wi-Fi Direct	Wi-Fi Direct enabled devices transfer data directly between each other ☒ Wi-Fi Direct (Wi-Fi 2.4 GHz) ☐ Wi-Fi Direct (Wi-Fi 5 GHz)
Device dimensions	Overall (Length x Width): 127.5 mm x 66.1 mm Overall Diagonal: 135.2 mm Display Diagonal: 114.0 mm
Back Cover	☒ Normal Battery Cover ☐ Wireless Charger Battery Cover ☐ Normal Battery Cover with NFC
Accessory	☒ Headset
Battery Options	☒ Standard – Lithium-ion battery, Rating 3.8 Vdc, 2440 mAh ☐ Extended (large capacity)

7.2. Wireless Technologies

Wireless Technology and Frequency Bands	GSM: 850 / 1900 W-CDMA Band: V / II LTE Band: 4 / 17 (FDD) Wi-Fi: 2.4 GHz Bluetooth: 2.4 GHz
Mode	GSM - ☒ Voice (GMSK) - ☒ GPRS (GMSK) - ☒ EGPRS (8PSK) W-CDMA - ☒ UMTS Rel. 99 - ☒ HSDPA (Rel. 5) - ☒ HSUPA (Rel. 6) - ☐ DC-HSDPA (Rel. 8) - ☐ HSPA+ (Rel.) LTE: QPSK, 16QAM Wi-Fi 2.4GHz (802.11b/g/n) - ☒ 802.11b - ☒ 802.11g - ☒ 802.11n (20MHz) - ☐ 802.11n (40MHz) - ☐ 802.11ac Bluetooth Ver. 4.0 (LE)
Duty Cycle (Used for SAR testing)	GSM Voice: 12.5%; GPRS 1 Slot: 12.5%, 2 Slots: 25% W-CDMA: 100% LTE (FDD): 100% Wi-Fi 802.11b/g/n: 100%
GPRS Multi-Slot Class	☐ Class 8 - One Up ☒ Class 10 - Two Up ☐ Class 12 - Four Up
DTM (Dual Transfer Mode)	☐ Supported
VoIP (GPRS)	☒ Supported
SV-LTE & SV-DO	☐ Supported

7.3. RF Output Power Tune-up Tolerance

Upper limit (dB): 0.5		RF Output Power (dBm)							
		Target				Max. tune-up tolerance limit			
RF Air interface	Mode	1 Slot	2 Slot	3 Slot	4 Slot	1 Slot	2 Slot	3 Slot	4 Slot
GSM850	Voice	33.2				**33.7**			
	GPRS	33.2	31.2			**33.7**	**31.7**		
	EGPRS	27.2	27.2			**27.7**	**27.7**		
GSM1900	Voice	30.2				**30.7**			
	GPRS	30.2	28.2			**30.7**	**28.7**		
	EGPRS	26.2	26.2			**26.7**	**26.7**		

Upper limit (dB): 0.5		RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit
W-CDMA Band V	Rel. 99	23.2	**23.7**
	HSDPA	23.2	**23.7**
	HSUPA	23.2	**23.7**
W-CDMA Band II	Rel. 99	23.2	**23.7**
	HSDPA	23.2	**23.7**
	HSUPA	23.2	**23.7**

Upper limit (dB): 0.5		RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit
LTE Band 4	QPSK	23.7	**24.2**
LTE Band 17	QPSK	23.7	**24.2**

Upper limit (dB): 1.0		RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit
WiFi 2.4 GHz	802.11b	15.7	**16.7**
	802.11g	12.0	**13.0**
	802.11n HT20	12.0	**13.0**

Upper limit (dB): 1.5	RF Output Power (dBm)	
RF Air interface	Target	Max. tune-up tolerance limit
Bluetooth	9.4	**10.9**
Bluetooth (LE)	0.5	**2.0**

7.4. Simultaneous Transmission Condition

RF Exposure Condition	Capable Transmit Configurations
Head	1. GSM 850/1900 Voice + Wi-Fi 2.4 GHz 2. GSM 850/1900 (GPRS/EDGE) + Wi-Fi 2.4 GHz (VoIP) 3. W-CDMA Band V / II+ Wi-Fi 2.4 GHz 4. LTE Band 4 / 17 + Wi-Fi 2.4GHz
Body-worn Accessory	1. GSM 850/1900 Voice + Wi-Fi 2.4 GHz 2. GSM 850/1900 Voice + BT 3. GSM 850/1900 (GPRS/EDGE) + Wi-Fi 2.4 GHz (VoIP) 4. GSM 850/1900 (GPRS/EDGE) + BT (VoIP) 5. W-CDMA Band V / II + Wi-Fi 2.4 GHz 6. W-CDMA Band V / II + BT 7. LTE Band 4 / 17 + Wi-Fi 2.4GHz 8. LTE Band 4 / 17 + BT
Wireless Router (Hotspot)	N/A
Wi-Fi Direct	N/A

Note:

1. Wi-Fi 2.4GHz and Bluetooth cannot transmit simultaneously.
2. Wi-Fi 2.4GHz also supports Wi-Fi Direct

7.5. General LTE SAR Test and Reporting Considerations

<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>Frequency range, Channel Bandwidth, Numbers and Frequencies</td><td>
<table>
<tr><td colspan="7">Band 4</td></tr>
<tr><td colspan="4">Tx: 1710 to 1755 MHz</td><td colspan="3">Rx: 2110 to 2155 MHz</td></tr>
<tr><td colspan="7">Band 17</td></tr>
<tr><td colspan="4">Tx: 704 to 716 MHz</td><td colspan="3">Rx: 734 to 746 MHz</td></tr>
<tr><td rowspan="2">Band 4</td><td colspan="6">Channel Bandwidth</td></tr>
<tr><td>20 MHz</td><td>15 MHz</td><td>10 MHz</td><td>5 MHz</td><td>3 MHz</td><td>1.4 MHz</td></tr>
<tr><td>Low</td><td></td><td></td><td>20000</td><td>19975</td><td></td><td></td></tr>
<tr><td>Mid</td><td></td><td></td><td>20175</td><td>20175</td><td></td><td></td></tr>
<tr><td>High</td><td></td><td></td><td>20350</td><td>20375</td><td></td><td></td></tr>
<tr><td rowspan="2">Band 17</td><td colspan="6">Channel Bandwidth</td></tr>
<tr><td>20 MHz</td><td>15 MHz</td><td>10 MHz</td><td>5 MHz</td><td>3 MHz</td><td>1.4 MHz</td></tr>
<tr><td>Low</td><td></td><td></td><td>23780</td><td>23755</td><td></td><td></td></tr>
<tr><td>Mid</td><td></td><td></td><td>23790</td><td>23790</td><td></td><td></td></tr>
<tr><td>High</td><td></td><td></td><td>23800</td><td>23825</td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>LTE transmitter and antenna implementation</td><td>LTE has two Tx/Rx antennas and two Rx only antennas.
Refer to Appendix “Antenna Locations and Separation Distances” for antenna locations</td></tr>
<tr><td>Maximum power reduction (MPR)</td><td>
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
</td></tr>
<tr><td>Power reduction</td><td>☐ Yes
☒ No</td></tr>
<tr><td>Spectrum plots for RB configurations</td><td>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.</td></tr>
</table>

8. RF Exposure Conditions

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

8.1. Head Exposure Conditions

For GSM, W-CDMA, LTE, Wi-Fi and Bluetooth

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 GSM, W-CDMA and LTE B4 (❶)

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

For LTE B17 (❷)

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

For Wi-Fi and Bluetooth (❻)

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

8.3. Wi-Fi Direct Exposure Conditions

For Wi-Fi (❻)

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	<25 mm	Yes	
Front	<25 mm	Yes	
Edge 1 (Top)	3 mm	Yes	
Edge 2 (Right)	54.1 mm	No	SAR is not required because the distance from the antenna to the edge is > 25 mm as per KDB 648474 D04 Handset SAR v01r01
Edge 3 (Bottom)	104.5 mm	No	SAR is not required because the distance from the antenna to the edge is > 25 mm as per KDB 648474 D04 Handset SAR v01r01
Edge 4 (Left	2 mm	Yes	

9. RF Output Power Measurement

9.1. GSM 850

GSM (GMSK) - Voice Mode

Band	Ch No.	Freq. (MHz)	Avg burst Pwr (dBm)
850	128	824.2	33.7
	190	836.6	33.7
	251	848.8	33.6

GPRS (GMSK) - Coding Scheme: CS1

Band	Ch No.	Freq. (MHz)	Avg Power (dBm)			
			1 time slot		2 time slots	
			Burst	Frame	Burst	Frame
850	128	824.2	33.7	24.7	**31.2**	25.2
	190	836.6	33.7	24.7	**31.1**	25.1
	251	848.8	33.6	24.6	**30.9**	24.9

EGPRS (8PSK) - Coding Scheme: MCS5

Band	Ch No.	Freq. (MHz)	Avg Power (dBm)			
			1 time slot		2 time slots	
			Burst	Frame	Burst	Frame
850	128	824.2	27.5	18.5	26.6	20.6
	190	836.6	27.4	18.4	26.5	20.5
	251	848.8	27.4	18.4	26.5	20.5

Notes:

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

- Head & Body-worn Accessory: GMSK Voice Mode
- For VoIP mode, GPRS (GMSK) mode with 2 time slots, based on the output power measurements above
- SAR is not required for EGPRS (8PSK) mode because its output power is less than that of GPRS Mode

9.2. GSM 1900

GSM (GMSK) - Voice Mode

Band	Ch No.	Freq. (MHz)	Avg burst Pwr (dBm)
1900	512	1850.2	30.5
	661	1880.0	30.7
	810	1909.8	30.7

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	30.5	21.5	**28.4**	22.4
	661	1880.0	30.7	21.7	**28.6**	22.6
	810	1909.8	30.7	21.7	**28.7**	22.7

EGPRS (8PSK) - Coding Scheme: MCS5

Band	Ch No.	Freq. (MHz)	Avg Power (dBm)			
			1 time slot		2 time slots	
			Burst	Frame	Burst	Frame
1900	512	1850.2	25.6	16.6	24.5	18.5
	661	1880.0	25.7	16.7	24.5	18.5
	810	1909.8	25.7	16.7	24.5	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
- For VoIP mode, GPRS (GMSK) mode with 2 time slots, based on the output power measurements above
- SAR is not required for EGPRS (8PSK) mode because its output power is more than that of GPRS Mode

9.3. W-CDMA

Release 99

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

Mode	Subtest	Rel99
W-CDMA General Settings	Loopback Mode	Test Mode 1
	Rel99 RMC	12.2kbps RMC
	Power Control Algorithm	Algorithm2
	βc/βd	8/15

Measured Results

Band	Mode	UL Ch No.	Freq. (MHz)	Avg Pwr (dBm)
W-CDMA Band V	Rel 99 (RMC, 12.2 kbps)	4132	826.4	23.7
		4183	836.6	23.7
		4233	846.6	23.6
W-CDMA Band II	Rel 99 (RMC, 12.2 kbps)	9262	1852.4	23.7
		9400	1880.0	23.7
		9538	1907.6	23.5

HSDPA

The following 4 Sub-tests were completed according to Release 5 procedures in section 5.2 of 3GPP TS34.121. A summary of these settings are illustrated below:

	Mode	HSDPA	HSDPA	HSDPA	HSDPA
	Subtest	1	2	3	4
W-CDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set1			
	Power Control Algorithm	Algorithm 2			
	βc	2/15	12/15	15/15	15/15
	βd	15/15	15/15	8/15	4/15
	Bd (SF)	64			
	βc/βd	2/15	12/15	15/8	15/4
	βhs	4/15	24/15	30/15	30/15
	MPR (dB)	0	0	0.5	0.5
HSDPA Specific Settings	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			
	Ahs=βhs/βc	30/15			

Measured Results

Band	Mode	UL Ch No.	Freq. (MHz)	Avg Pwr (dBm)
W-CDMA Band V	Subtest 1	4132	826.4	23.5
		4183	836.6	23.6
		4233	846.6	23.5
	Subtest 2	4132	826.4	23.6
		4183	836.6	23.6
		4233	846.6	23.6
	Subtest 3	4132	826.4	23.1
		4183	836.6	23.1
		4233	846.6	23.1
	Subtest 4	4132	826.4	23.2
		4183	836.6	23.1
		4233	846.6	23.1
W-CDMA Band II	Subtest 1	9262	1852.4	23.6
		9400	1880.0	23.7
		9538	1907.6	23.5
	Subtest 2	9262	1852.4	23.7
		9400	1880.0	23.7
		9538	1907.6	23.7
	Subtest 3	9262	1852.4	23.1
		9400	1880.0	23.2
		9538	1907.6	23.1
	Subtest 4	9262	1852.4	23.2
		9400	1880.0	23.2
		9538	1907.6	23.1

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

Note(s):

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

HSPA (HSDPA & HSUPA)

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

	Mode	HSPA	HSPA	HSPA	HSPA	HSPA
	Subtest	1	2	3	4	5
W-CDMA General Settings	Loopback Mode	Test Mode 1				
	Rel99 RMC	12.2kbps RMC				
	HSDPA FRC	H-Set1				
	HSUPA Test	HSUPA Loopback				
	Power Control Algorithm	Algorithm2				
	βc	11/15	6/15	15/15	2/15	15/15
	βd	15/15	15/15	9/15	15/15	15/15
	βec	209/225	12/15	30/15	2/15	24/15
	βc/βd	11/15	6/15	15/9	2/15	15/15
	βhs	22/15	12/15	30/15	4/15	30/15
	βed	1309/225	94/75	47/15 47/15	56/75	134/15
	CM (dB)	1.0	3.0	2.0	3.0	1.0
	MPR (dB)	0	2	1	2	0
HSDPA Specific Settings	DACK	8				
	DNAK	8				
	DCQI	8				
	Ack-Nack repetition factor	3				
	CQI Feedback (Table 5.2B.4)	4ms				
	CQI Repetition Factor (Table 5.2B.4)	2				
	Ahs = βhs/βc	30/15				
HSUPA Specific Settings	D E-DPCCH	6	8	8	5	7
	DHARQ	0	0	0	0	0
	AG Index	20	12	15	17	21
	ETFCI (from 34.121 Table C.11.1.3)	75	67	92	71	81
	Associated Max UL Data Rate kbps	242.1	174.9	482.8	205.8	308.9
	Reference E_TFCIs	E-TFCI 11 E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO 23 E-TFCI 75 E-TFCI PO 26 E-TFCI 81 E-TFCI PO 27		E-TFCI 11 E-TFCI PO 4 E-TFCI 92 E-TFCI PO 18	E-TFCI 11 E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO 23 E-TFCI 75 E-TFCI PO 26 E-TFCI 81 E-TFCI PO 27	

Measured Results

Band	Mode	UL Ch No.	Freq. (MHz)	Avg Pwr (dBm)
W-CDMA Band V	Subtest 1	4132	826.4	23.5
		4183	836.6	23.1
		4233	846.6	23.5
	Subtest 2	4132	826.4	21.3
		4183	836.6	21.9
		4233	846.6	22.0
	Subtest 3	4132	826.4	22.3
		4183	836.6	22.6
		4233	846.6	22.4
	Subtest 4	4132	826.4	22.3
		4183	836.6	22.4
		4233	846.6	22.2
	Subtest 5	4132	826.4	23.7
		4183	836.6	23.7
		4233	846.6	23.7
W-CDMA Band II	Subtest 1	9262	1852.4	23.1
		9400	1880.0	23.2
		9538	1907.6	23.2
	Subtest 2	9262	1852.4	22.3
		9400	1880.0	22.3
		9538	1907.6	21.7
	Subtest 3	9262	1852.4	22.4
		9400	1880.0	22.6
		9538	1907.6	22.5
	Subtest 4	9262	1852.4	22.1
		9400	1880.0	22.4
		9538	1907.6	22.1
	Subtest 5	9262	1852.4	23.7
		9400	1880.0	23.6
		9538	1907.6	23.6

Note(s):

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

9.4. LTE Bands

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 4 Measured Results

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							1715 MHz	1732.5 MHz	1750 MHz
LTE Band 4	10	QPSK	1	0	0	0	24.1	24.1	24.2
			1	25	0	0	24.0	24.0	24.1
			1	49	0	0	24.1	24.1	24.2
			25	0	1	1	23.0	22.9	22.8
			25	12	1	1	23.0	22.9	22.9
			25	25	1	1	23.0	22.9	22.9
			50	0	1	1	22.9	23.0	22.8
		16QAM	1	0	1	1	23.1	23.2	23.1
			1	25	1	1	23.1	23.1	23.0
			1	49	1	1	23.1	23.1	23.1
			25	0	2	2	21.9	21.9	21.8
			25	12	2	2	21.8	22.0	21.8
			25	25	2	2	21.8	22.0	21.8
			50	0	2	2	21.8	21.9	21.8
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							1712.5 MHz	1732.5 MHz	1752.5 MHz
LTE Band 4	5	QPSK	1	0	0	0	24.2	24.1	24.1
			1	12	0	0	24.2	24.1	24.2
			1	24	0	0	24.1	24.1	24.2
			12	0	1	1	23.2	23.1	23.1
			12	6	1	1	23.2	23.1	23.2
			12	11	1	1	23.2	23.1	23.1
			25	0	1	1	23.2	23.1	23.1
		16QAM	1	0	1	1	23.2	23.1	23.1
			1	12	1	1	23.1	23.1	23.1
			1	24	1	1	23.2	23.2	23.1
			12	0	2	2	21.9	22.0	22.0
			12	6	2	2	22.0	22.0	22.1
			12	11	2	2	22.1	22.1	22.0
			25	0	2	2	22.0	22.0	22.1

LTE Band 17 Measured Results

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)
							710 MHz
LTE Band 17	10	QPSK	1	0	0	0	24.0
			1	25	0	0	24.2
			1	49	0	0	24.2
			25	0	1	1	22.8
			25	12	1	1	23.0
			25	25	1	1	23.0
			50	0	1	1	23.1
		16QAM	1	0	1	1	22.9
			1	25	1	1	23.1
			1	49	1	1	23.1
			25	0	2	2	21.8
			25	12	2	2	21.9
			25	25	2	2	22.1
			50	0	2	2	22.0
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)
							710 MHz
LTE Band 17	5	QPSK	1	0	0	0	23.9
			1	12	0	0	24.1
			1	24	0	0	24.1
			12	0	1	1	23.0
			12	6	1	1	23.2
			12	11	1	1	23.0
			25	0	1	1	23.0
		16QAM	1	0	1	1	22.8
			1	12	1	1	23.0
			1	24	1	1	23.1
			12	0	2	2	21.9
			12	6	2	2	22.1
			12	11	2	2	22.0
			25	0	2	2	22.0

9.5. Wi-Fi (2.4 GHz Band)

Required Test Channels per KDB 248227 D01

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

Notes:
√ = "default test channels"
∇ = possible 802.11g channels with maximum average output ¼ 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	Ch #	Freq. (MHz)	Avg Pwr (dBm)	SAR test (Yes/No)
2.4 (DTS)	802.11b	1	2412	15.9	Yes
		6	2437	15.2	
		11	2462	14.8	
	802.11g	1	2412	13.0	No
		6	2437	12.6	
		11	2462	12.3	
	802.11n (HT20)	1	2412	12.7	No
		6	2437	12.6	
		11	2462	12.4	

Power measurements to determine worst-case data rates

Mode	Ch #	Freq. (MHz)	Data Rate	Avg Pwr (dBm)	SAR test (Yes/No)
802.11b	6	2437	1 Mbps	15.9	Yes
			2 Mbps	15.8	No
			5.5 Mbps	15.8	No
			11 Mbps	15.8	No

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

9.6. Bluetooth

Maximum tune-up tolerance limit is 10.9 dBm from the rated nominal maximum output power. This power level qualifies for exclusion of SAR testing.

Refer to Standalone SAR Test Exclusion Considerations Section.

10. Tissue Dielectric Properties

IEEE Std 1528-2013

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

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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^2O	Water, 35 – 58%
Sucrese	Sugar, white, refined, 40-60%
NaCl	Sodium Chloride, 0-6%
Hydroxyethel-cellulsoe	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-methyyl-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^2O	Water, 52 – 75%
C8H18O3	Diethylene glycol monobutyl ether (DGBE), 25-48%
NaCl	Sodium Chloride, <1.0%

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 ± 2°C of the temperature when the tissue parameters are characterized.

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

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

SAR Lab A

	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
12/14/2013	Head 1900	e'	38.1400	Relative Permittivity (ϵ_r):	38.14	40.00	-4.65	5
		e''	13.6400	Conductivity (σ):	1.44	1.40	2.93	5
	Head 1850	e'	38.0600	Relative Permittivity (ϵ_r):	38.06	40.00	-4.85	5
		e''	13.7500	Conductivity (σ):	1.41	1.40	1.03	5
	Head 1910	e'	38.1100	Relative Permittivity (ϵ_r):	38.11	40.00	-4.73	5
		e''	13.7800	Conductivity (σ):	1.46	1.40	4.53	5
12/14/2013	Body 1900	e'	54.9500	Relative Permittivity (ϵ_r):	54.95	53.30	3.10	5
		e''	14.8900	Conductivity (σ):	1.57	1.52	3.49	5
	Body 1850	e'	55.2000	Relative Permittivity (ϵ_r):	55.20	53.30	3.56	5
		e''	14.7700	Conductivity (σ):	1.52	1.52	-0.04	5
	Body 1910	e'	54.8800	Relative Permittivity (ϵ_r):	54.88	53.30	2.96	5
		e''	14.9000	Conductivity (σ):	1.58	1.52	4.11	5

SAR Lab D

	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
12/13/2013	Head 1750	e'	39.0700	Relative Permittivity (ϵ_r):	39.07	40.08	-2.53	5
		e''	14.1400	Conductivity (σ):	1.38	1.37	0.51	5
	Head 1710	e'	39.2400	Relative Permittivity (ϵ_r):	39.24	40.15	-2.26	5
		e''	14.0700	Conductivity (σ):	1.34	1.35	-0.64	5
	Head 1755	e'	39.0400	Relative Permittivity (ϵ_r):	39.04	40.08	-2.59	5
		e''	14.1500	Conductivity (σ):	1.38	1.37	0.66	5
12/13/2013	Body 1750	e'	52.7500	Relative Permittivity (ϵ_r):	52.75	53.44	-1.29	5
		e''	15.6900	Conductivity (σ):	1.53	1.49	2.73	5
	Body 1710	e'	52.9000	Relative Permittivity (ϵ_r):	52.90	53.54	-1.20	5
		e''	15.6100	Conductivity (σ):	1.48	1.46	1.55	5
	Body 1755	e'	52.7500	Relative Permittivity (ϵ_r):	52.75	53.43	-1.27	5
		e''	15.7200	Conductivity (σ):	1.53	1.49	3.01	5
12/16/2013	Head 835	e'	40.0300	Relative Permittivity (ϵ_r):	40.03	41.50	-3.54	5
		e''	19.3700	Conductivity (σ):	0.90	0.90	-0.08	5
	Head 820	e'	40.3000	Relative Permittivity (ϵ_r):	40.30	41.60	-3.13	5
		e''	19.4200	Conductivity (σ):	0.89	0.90	-1.45	5
	Head 850	e'	39.8700	Relative Permittivity (ϵ_r):	39.87	41.50	-3.93	5
		e''	19.3100	Conductivity (σ):	0.91	0.92	-0.26	5
12/16/2013	Body 835	e'	54.4800	Relative Permittivity (ϵ_r):	54.48	55.20	-1.30	5
		e''	21.5900	Conductivity (σ):	1.00	0.97	3.34	5
	Body 820	e'	54.6200	Relative Permittivity (ϵ_r):	54.62	55.28	-1.19	5
		e''	21.6600	Conductivity (σ):	0.99	0.97	1.97	5
	Body 850	e'	54.3500	Relative Permittivity (ϵ_r):	54.35	55.16	-1.46	5
		e''	21.5200	Conductivity (σ):	1.02	0.99	3.03	5

SAR Lab D (continued)

	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
12/17/2013	Head 2450	e'	38.1000	Relative Permittivity (ϵ_r):	38.10	39.20	-2.81	5
		e''	13.5700	Conductivity (σ):	1.85	1.80	2.70	5
	Head 2410	e'	38.2900	Relative Permittivity (ϵ_r):	38.29	39.28	-2.52	5
		e''	13.4500	Conductivity (σ):	1.80	1.76	2.38	5
	Head 2475	e'	37.9900	Relative Permittivity (ϵ_r):	37.99	39.17	-3.01	5
		e''	13.6200	Conductivity (σ):	1.87	1.83	2.59	5
12/16/2013	Body 2450	e'	50.8400	Relative Permittivity (ϵ_r):	50.84	52.70	-3.53	5
		e''	14.2500	Conductivity (σ):	1.94	1.95	-0.45	5
	Body 2410	e'	50.9500	Relative Permittivity (ϵ_r):	50.95	52.76	-3.43	5
		e''	14.0700	Conductivity (σ):	1.89	1.91	-1.16	5
	Body 2475	e'	50.7200	Relative Permittivity (ϵ_r):	50.72	52.67	-3.70	5
		e''	14.3400	Conductivity (σ):	1.97	1.99	-0.59	5
1/22/2014	Body 2450	e'	50.7200	Relative Permittivity (ϵ_r):	50.72	52.70	-3.76	5
		e''	13.8800	Conductivity (σ):	1.89	1.95	-3.03	5
	Body 2410	e'	50.8000	Relative Permittivity (ϵ_r):	50.80	52.76	-3.71	5
		e''	13.5500	Conductivity (σ):	1.82	1.91	-4.81	5
	Body 2475	e'	50.5300	Relative Permittivity (ϵ_r):	50.53	52.67	-4.06	5
		e''	13.8000	Conductivity (σ):	1.90	1.99	-4.33	5

SAR Lab F

	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
12/18/2013	Head 750	e'	40.2800	Relative Permittivity (ϵ_r):	40.28	41.96	-4.01	5
		e''	21.5900	Conductivity (σ):	0.90	0.89	0.81	5
	Head 700	e'	40.9500	Relative Permittivity (ϵ_r):	40.95	42.22	-3.00	5
		e''	21.9600	Conductivity (σ):	0.85	0.89	-3.88	5
	Head 790	e'	39.7700	Relative Permittivity (ϵ_r):	39.77	41.76	-4.76	5
		e''	21.3100	Conductivity (σ):	0.94	0.90	4.45	5
12/18/2013	Body 750	e'	55.1400	Relative Permittivity (ϵ_r):	55.14	55.55	-0.73	5
		e''	23.4100	Conductivity (σ):	0.98	0.96	1.37	5
	Body 700	e'	55.7100	Relative Permittivity (ϵ_r):	55.71	55.74	-0.05	5
		e''	23.8300	Conductivity (σ):	0.93	0.96	-3.31	5
	Body 790	e'	54.7100	Relative Permittivity (ϵ_r):	54.71	55.39	-1.23	5
		e''	23.0500	Conductivity (σ):	1.01	0.97	4.80	5

SAR Lab 3

	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
1/24/2014	Body 2450	e'	53.6300	Relative Permittivity (ϵ_r):	53.63	52.70	1.76	5
		e''	14.6300	Conductivity (σ):	1.99	1.95	2.21	5
	Body 2410	e'	53.7200	Relative Permittivity (ϵ_r):	53.72	52.76	1.82	5
		e''	14.4800	Conductivity (σ):	1.94	1.91	1.72	5
	Body 2475	e'	53.5400	Relative Permittivity (ϵ_r):	53.54	52.67	1.65	5
		e''	14.7000	Conductivity (σ):	2.02	1.99	1.91	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
D750V3	1071	11/15/2013	750	1g	8.46	8.64
				10g	5.51	5.72
D835V2	4d002	11/15/2013	835	1g	9.49	9.43
				10g	6.18	6.21
D1750V2	1077	9/12/2013	1750	1g	37.6	37.7
				10g	20.0	20.3
D1900V2	5d043	11/12/2013	1900	1g	40.1	39.0
				10g	21.1	20.8
D2450V2	748	2/11/2013	2450	1g	52.9	49.9
				10g	24.6	23.2
D2450V2	899	9/10/2013	2450	1g	51.3	49.7
				10g	23.9	23.3

11.3. System Performance Check Results

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

SAR Lab A

Date Tested	System Dipole		T.S. Liquid		Measured Results			Target (Ref. Value)	Delta ±10 %	Est./Zoom Ratio	Plot No.
	Type	Serial #			Area Scan	Zoom Scan	Normalize to 1 W				
12/14/2013	D1900V2	5d043	Head	1g	4.08	3.99	39.9	40.1	-0.50	2.21	
				10g	2.14	2.05	20.5	21.1	-2.84		
12/14/2013	D1900V2	5d043	Body	1g	4.29	4.16	41.6	39.0	**6.67**	3.03	1,2
				10g	2.17	2.11	21.1	20.8	1.44		

SAR Lab D

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				
12/13/2013	D1750V2	1077	Head	1g	3.85	3.72	37.2	37.6	-1.06	3.38	
				10g	2.05	1.95	19.5	20.0	-2.50		
12/13/2013	D1750V2	1077	Body	1g	3.82	3.72	37.2	37.7	**-1.33**	2.62	3,4
				10g	1.96	1.97	19.7	20.3	-2.96		
12/16/2013	D835V2	4d002	Head	1g	0.978	0.956	9.56	9.49	0.74	2.25	
				10g	0.658	0.625	6.25	6.18	1.13		
12/16/2013	D835V2	4d002	Body	1g	1.01	0.997	9.97	9.43	**5.73**	1.29	5,6
				10g	0.677	0.656	6.56	6.21	5.64		
12/17/2013	D2450V2	748	Head	1g	5.54	5.52	55.2	52.9	4.35	0.36	
				10g	2.40	2.47	24.7	24.6	0.41		
12/16/2013	D2450V2	748	Body	1g	4.75	4.71	47.1	49.9	**-5.61**	0.84	7,8
				10g	2.08	2.17	21.7	23.2	-6.47		
1/22/2014	D2450V2	899	Body	1g	5.10	4.96	49.6	49.7	**-0.20**	2.75	9,10
				10g	2.31	2.27	22.7	23.3	-2.58		

SAR Lab F

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				
12/18/2013	D750V2	1071	Head	1g	0.881	0.855	8.55	8.46	1.06	2.95	
				10g	0.599	0.558	5.58	5.51	1.27		
12/18/2013	D750V2	1071	Body	1g	0.902	0.884	8.84	8.64	**2.31**	2.00	11,12
				10g	0.611	0.589	5.89	5.72	2.97		

SAR Lab 3

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				
1/24/2014	D2450V2	899	Body	1g	5.24	5.24	52.4	49.7	**5.43**	0.00	13,14
				10g	2.34	2.44	24.4	23.3	4.72		

12. SAR Test Results

SAR Channel Exclusion criteria are as follows:

1. As stated in KDB 447498 D01 General RF Exposure Guidance v05r01, 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
2. 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 $\geq$ 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.

12.1. GSM 850

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Voice	0	Left Touch	190	836.6	33.7	33.7	0.409	0.409	1
			Left Tilt	190	836.6	33.7	33.7	0.255	0.255	
			Right Touch	190	836.6	33.7	33.7	0.348	0.348	
			Right Tilt	190	836.6	33.7	33.7	0.234	0.234	
	GPRS 2 Slots	0	Left Touch	190	836.6	31.7	31.1	0.435	0.499	2
			Left Tilt	190	836.6	31.7	31.1	0.260	0.299	
			Right Touch	190	836.6	31.7	31.1	0.338	0.388	
			Right Tilt	190	836.6	31.7	31.1	0.227	0.261	
Body-worn	Voice	15	Rear	190	836.6	31.2	31.1	0.510	0.522	3
			Front	190	836.6	31.2	31.1	0.388	0.397	
	GPRS 2 Slots	15	Rear	190	836.6	31.2	31.1	0.533	0.545	4
			Front	190	836.6	31.2	31.1	0.391	0.400	

12.2. GSM 1900

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Voice	0	Left Touch	661	1880.0	30.7	30.7	0.185	0.185	
			Left Tilt	661	1880.0	30.7	30.7	0.089	0.089	
			Right Touch	661	1880.0	30.7	30.7	0.215	0.215	5
			Right Tilt	661	1880.0	30.7	30.7	0.105	0.105	
	GPRS 2 Slots	0	Left Touch	661	1880.0	28.7	28.6	0.237	0.243	
			Left Tilt	661	1880.0	28.7	28.6	0.112	0.115	
			Right Touch	661	1880.0	28.7	28.6	0.263	0.269	6
			Right Tilt	661	1880.0	28.7	28.6	0.131	0.134	
Body-worn	Voice	15	Rear	661	1880.0	30.7	30.7	0.211	0.211	7
			Front	661	1880.0	30.7	30.7	0.136	0.136	
	GPRS 2 Slots	15	Rear	661	1880.0	28.7	28.6	0.274	0.280	8
			Front	661	1880.0	28.7	28.6	0.180	0.184	

12.3. W-CDMA Band V

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Rel 99 RMC 12.2 kbps	0	Left Touch	4183	836.6	23.7	23.7	0.412	0.412	9
			Left Tilt	4183	836.6	23.7	23.7	0.236	0.236	
			Right Touch	4183	836.6	23.7	23.7	0.309	0.309	
			Right Tilt	4183	836.6	23.7	23.7	0.213	0.213	
Body-worn	Rel 99 RMC 12.2 kbps	15	Rear	4183	836.6	23.7	23.7	0.438	0.438	10
			Front	4183	836.6	23.7	23.7	0.325	0.325	

12.4. W-CDMA Band II

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Rel 99 RMC 12.2 kbps	0	Left Touch	9400	1880.0	23.7	23.7	0.411	0.411	11
			Left Tilt	9400	1880.0	23.7	23.7	0.165	0.165	
			Right Touch	9400	1880.0	23.7	23.7	0.389	0.389	
			Right Tilt	9400	1880.0	23.7	23.7	0.196	0.196	
Body-worn	Rel 99 RMC 12.2 kbps	15	Rear	9400	1880.0	23.7	23.7	0.432	0.432	12
			Front	9400	1880.0	23.7	23.7	0.265	0.265	

12.5. LTE Band 4 (10MHz Bandwidth)

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	UL Ch #.	Freq. (MHz)	RB Allocation	RB offset	Power (dBm)		1-g SAR (W/kg)		Plot No.
								Tune-up limit	Meas.	Meas.	Scaled	
Head	QPSK	0	Left Touch	20175	1732.5	1	0	24.2	24.1	0.331	0.339	13
						25	0	23.2	22.9	0.251	0.269	
			Left Tilt	20175	1732.5	1	0	24.2	24.1	0.169	0.173	
						25	0	23.2	22.9	0.128	0.137	
			Right Touch	20175	1732.5	1	0	24.2	24.1	0.301	0.308	
						25	0	23.2	22.9	0.223	0.239	
			Right Tilt	20175	1732.5	1	0	24.2	24.1	0.126	0.129	
						25	0	23.2	22.9	0.095	0.102	
Body-worn	QPSK	15	Rear	20175	1732.5	1	0	24.2	24.1	0.556	0.569	14
						25	0	23.2	22.9	0.420	0.450	
			Front	20175	1732.5	1	0	24.2	24.1	0.278	0.284	
						25	0	23.2	22.9	0.209	0.224	

12.6. LTE Band 17 (10MHz Bandwidth)

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	UL Ch #.	Freq. (MHz)	RB Allocation	RB offset	Power (dBm)		1-g SAR (W/kg)		Plot No.
								Tune-up limit	Meas.	Meas.	Scaled	
Head	QPSK	0	Left Touch	23790	710.0	1	25	24.2	24.2	0.269	0.269	
						25	12	23.2	23.0	0.193	0.202	
			Left Tilt	23790	710.0	1	25	24.2	24.2	0.141	0.141	
						25	12	23.2	23.0	0.100	0.105	
			Right Touch	23790	710.0	1	25	24.2	24.2	0.287	0.287	15
						25	12	23.2	23.0	0.206	0.216	
			Right Tilt	23790	710.0	1	25	24.2	24.2	0.166	0.166	
						25	12	23.2	23.0	0.116	0.121	
Body-worn	QPSK	15	Rear	23790	710.0	1	25	24.2	24.2	0.449	0.449	16
						25	12	23.2	23.0	0.322	0.337	
			Front	23790	710.0	1	25	24.2	24.2	0.274	0.274	
						25	12	23.2	23.0	0.192	0.201	

12.7. Wi-Fi (DTS Band)

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	802.11b	0	Left Touch	1	2412	16.7	15.9	0.025	0.030	
			Left Tilt	1	2412	16.7	15.9	0.020	0.024	
			Right Touch	1	2412	16.7	15.9	0.046	0.055	17
			Right Tilt	1	2412	16.7	15.9	0.027	0.032	
Body-worn & Wi-Fi Direct	802.11b	10	Rear	1	2412	16.7	15.9	0.064	0.077	18
			Front	1	2412	16.7	15.9	0.023	0.028	
Wi-Fi Direct	802.11b	10	Edge 1	1	2412	16.7	15.9	0.027	0.032	
			Edge 4	1	2412	16.7	15.9	0.035	0.042	

12.8. Bluetooth

12.8.1. 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:

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

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

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

Body-worn Accessory Exposure Conditions

Max. tune-up tolerance limit		Min. test separation distance (mm)	Frequency (GHz)	Result
(dBm)	(mW)			
10.9	12	15	2.480	1.3

Conclusion:

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

12.8.2. 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:

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

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	12	15	2.480	0.168

13. SAR Measurement Variability

In accordance with published RF Exposure KDB procedure 865664 D01 SAR measurement 100 MHz to 6 GHz v01r01. These additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

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

13.1. The Highest Measured SAR Configuration in Each Frequency Band

Frequency Band (MHz)	Air Interface	Head (W/kg)	Body-worn Accessory (W/kg)	Hotspot/Wi-Fi Direct (W/kg)
700	LTE Band 17	<0.8 W/kg	<0.8 W/kg	N/A
850	GSM 850	<0.8 W/kg	<0.8 W/kg	N/A
	W-CDMA Band V	<0.8 W/kg	<0.8 W/kg	N/A
1900	GSM 1900	<0.8 W/kg	<0.8 W/kg	N/A
	W-CDMA Band II	<0.8 W/kg	<0.8 W/kg	N/A
1750	LTE Band 4	<0.8 W/kg	<0.8 W/kg	N/A
2400	Wi-Fi 802.11b/g/n	<0.8 W/kg	<0.8 W/kg	N/A

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:

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

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

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

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

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

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

RF Exposure conditions	Test Position	Simultaneous Transmission Scenario			∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)
		GSM 850	WiFi DTS Band	Bluetooth		
Head	Left Touch	0.499	0.030		0.529	No
	Left Tilt	0.299	0.024		0.323	No
	Right Touch	0.388	0.055		0.443	No
	Right Tilt	0.261	0.032		0.293	No
Body-worn	Rear	0.545	0.077		0.622	No
		0.545		0.168	0.713	No
	Front	0.400	0.028		0.428	No
		0.400		0.168	0.568	No

SAR to Peak Location Separation Ratio (SPLSR)
As the Sum of the SAR is not greater than 1.6 W/kg SPLSR assessment is not required.

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

RF Exposure conditions	Test Position	Simultaneous Transmission Scenario			∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)
		GSM 1900	WiFi DTS Band	Bluetooth		
Head	Left Touch	0.243	0.030		0.273	No
	Left Tilt	0.115	0.024		0.139	No
	Right Touch	0.269	0.055		0.324	No
	Right Tilt	0.134	0.032		0.166	No
Body-worn	Rear	0.280	0.077		0.357	No
		0.280		0.168	0.448	No
	Front	0.184	0.028		0.212	No
		0.184		0.168	0.352	No

SAR to Peak Location Separation Ratio (SPLSR)
As the Sum of the SAR is not greater than 1.6 W/kg SPLSR assessment is not required.

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

RF Exposure conditions	Test Position	Simultaneous Transmission Scenario			∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)
		W-CDMA Band V	WiFi DTS Band	Bluetooth		
Head	Left Touch	0.412	0.030		0.442	No
	Left Tilt	0.236	0.024		0.260	No
	Right Touch	0.309	0.055		0.364	No
	Right Tilt	0.213	0.032		0.245	No
Body-worn	Rear	0.438	0.077		0.515	No
		0.438		0.168	0.606	No
	Front	0.325	0.028		0.353	No
		0.325		0.168	0.493	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.

14.4. Sum of the SAR for W-CDMA Band II, Wi-Fi, & BT

RF Exposure conditions	Test Position	Simultaneous Transmission Scenario			∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)
		W-CDMA Band II	WiFi DTS Band	Bluetooth		
Head	Left Touch	0.411	0.030		0.441	No
	Left Tilt	0.165	0.024		0.189	No
	Right Touch	0.389	0.055		0.444	No
	Right Tilt	0.196	0.032		0.228	No
Body-worn	Rear	0.432	0.077		0.509	No
		0.432		0.168	0.600	No
	Front	0.265	0.028		0.293	No
		0.265		0.168	0.433	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.

14.5. Sum of the SAR for LTE Band 4, Wi-Fi, & BT

RF Exposure conditions	Test Position	Simultaneous Transmission Scenario			∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)
		LTE Band 4	WiFi DTS Band	Bluetooth		
Head	Left Touch	0.339	0.030		0.369	No
	Left Tilt	0.173	0.024		0.197	No
	Right Touch	0.308	0.055		0.363	No
	Right Tilt	0.129	0.032		0.161	No
Body-worn	Rear	0.569	0.077		0.646	No
		0.569		0.168	0.737	No
	Front	0.284	0.028		0.312	No
		0.284		0.168	0.452	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.

14.6. Sum of the SAR for LTE Band 17, Wi-Fi, & BT

RF Exposure conditions	Test Position	Simultaneous Transmission Scenario			∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)
		LTE Band 17	WiFi DTS Band	Bluetooth		
Head	Left Touch	0.269	0.030		0.299	No
	Left Tilt	0.141	0.024		0.165	No
	Right Touch	0.287	0.055		0.342	No
	Right Tilt	0.166	0.032		0.198	No
Body-worn	Rear	0.449	0.077		0.526	No
		0.449		0.168	0.617	No
	Front	0.274	0.028		0.302	No
		0.274		0.168	0.442	No

SAR to Peak Location Separation Ratio (SPLSR)
As the Sum of the SAR is not greater than 1.6 W/kg SPLSR assessment is not required.

15. Appendixes

Refer to separated files for the following appendixes.

15.1. Photos and Antenna Locations

15.2. System Performance Check Plots

15.3. Highest SAR Test Plots

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

15.5. Calibration Certificate for E-Field Probe EX3DV4 - SN 3686

15.6. Calibration Certificate for E-Field Probe EX3DV4 - SN 3885

15.7. Calibration Certificate for E-Field Probe EX3DV4 - SN 3902

15.8. Calibration Certificate for D750V3 - SN 1071

15.9. Calibration Certificate for D835V2 - SN 4d002

15.10. Calibration Certificate for D1750V2- SN 1077

15.11. Calibration Certificate for D1900V2- SN 5d043

15.12. Calibration Certificate for D2450V2 - SN 748

15.13. Calibration Certificate for D2450V2 - SN 899

END OF REPORT