SAR EVALUATION REPORT

FCC 47 CFR § 2.1093
IEEE Std 1528-2013

For
GSM/WCDMA/LTE PHONE + BLUETOOTH, & DTS b/g/n

FCC ID: ZNFL33L
Model Name: LG-L33L, L33L, LGL33L

Report Number: 14I19561-S1
Issue Date: 1/30/2015

Prepared for
LG ELECTRONICS MOBILECOMM U.S.A., INC.
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Date	Revisions	Revised By
--	1/30/2015	Initial Issue	--

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1. Attestation of Test Results

Applicant Name	LG ELECTRONICS MOBILECOMM U.S.A., INC.			
FCC ID	ZNFL33L			
Model Name	LG-L33L, L33L, LGL33L			
Applicable Standards	FCC 47 CFR § 2.1093 Published RF exposure KDB procedures IEEE Std 1528-2013			
SAR Limits (W/Kg)				
Exposure Category	Peak spatial-average (1g of tissue)			
General population / Uncontrolled exposure	1.6			
The Highest Reported SAR (W/kg)				
RF Exposure Conditions	**Equipment Class**			
	Licensed	**DTS**	**U-NII**	**DSS (BT)**
Head	0.827	0.356	N/A	N/A
Body-worn	1.160	0.091		
Hotspot/Wi-Fi Direct	1.160	0.091		
Simultaneous TX	1.251	1.251		
Date Tested	12/9/2014 to 12/23/2014			
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:
	
Bobby Bayani Senior Engineer UL Verification Services Inc.	Jose Abadilla Laboratory Technician UL Verification Services Inc.

2. Test Specification, Methods and Procedures

The tests documented in this report were performed in accordance with FCC 47 CFR § 2.1093, IEEE STD 1528-2013, the following FCC Published RF exposure KDB procedures:

- 248227 D01 SAR meas for IEEE 802 11 transmitters DR01-41733l
- 447498 D01 General RF Exposure Guidance v05r02
- 648474 D04 Handset SAR v01r02
- 690783 D01 SAR Listings on Grants v01r03
- 865664 D01 SAR measurement 100 MHz to 6 GHz v01r03
- 865664 D02 RF Exposure Reporting v01r01
- 941225 D01 3G SAR Procedures v03
- 941225 D05 SAR for LTE Devices v02r03
- 941225 D06 Hotspot Mode v02

3. Facilities and Accreditation

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

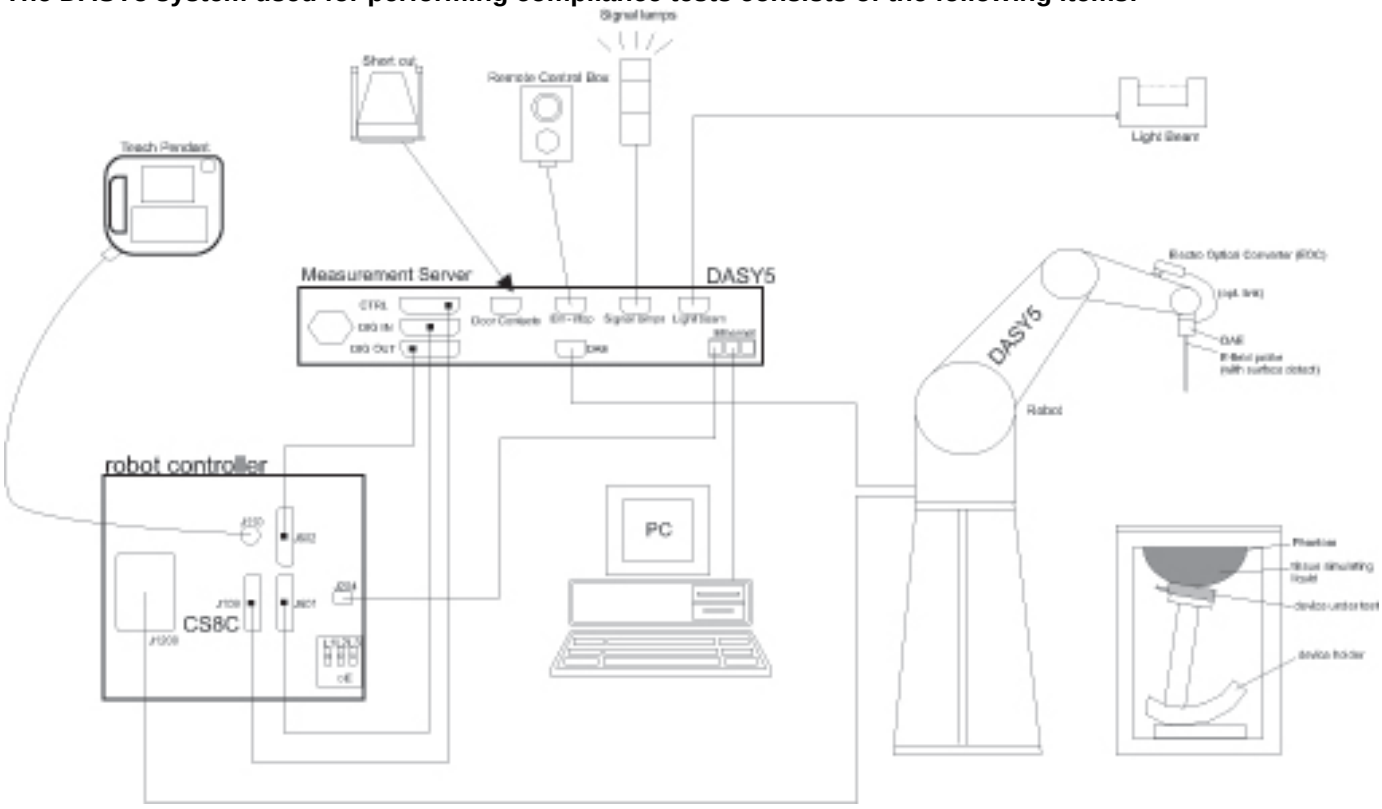
47173 Benicia Street	47266 Benicia Street
SAR Lab A	SAR Lab 1
SAR Lab B	SAR Lab 2
SAR Lab C	SAR Lab 3
SAR Lab D	SAR Lab 4
SAR Lab E	SAR Lab 5
SAR Lab F	
SAR Lab G	
SAR Lab H	

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0.

4. SAR Measurement System & Test Equipment

4.1. SAR Measurement System

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



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

4.2. SAR Scan Procedures

Step 1: Power Reference Measurement

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

Step 2: Area Scan

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

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

<table>
<tr><td></td><td>≤ 3 GHz</td><td>> 3 GHz</td></tr>
<tr><td>Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 ± 1 mm</td><td>½·δ·ln(2) ± 0.5 mm</td></tr>
<tr><td>Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td rowspan="2">Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}</td><td>≤ 2 GHz: ≤ 15 mm
2 – 3 GHz: ≤ 12 mm</td><td>3 – 4 GHz: ≤ 12 mm
4 – 6 GHz: ≤ 10 mm</td></tr>
<tr><td colspan="2">When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.</td></tr>
</table>

Step 3: Zoom Scan

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

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

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

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

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

Step 4: Power drift measurement

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

Step 5: Z-Scan (FCC only)

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

4.3. Test Equipment

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

Dielectric Property Measurements

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Network Analyzer	Agilent	E5071B	MY40001647	7/15/2015
Dielectronic Probe kit	SPEAG	DAK-3.5	1103	2/18/2015
Dielectronic Probe kit	SPEAG	DAK-3.5 Short	SM DAK 200 BA	N/A
Thermometer	Cole-Parmer Instrument Co.	91100-50	1007	7/31/2015

System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Synthesized Signal Generator	HP	8665B	3744A01084	5/20/2015
Power Meter	HP	437B	3125U11364	8/27/2015
Power Meter	HP	437B	3125U12345	8/15/2015
Power Sensor	Agilent	8481A	2702A76223	9/17/2015
Power Sensor	Agilent	8481A	1926A27048	8/20/2015
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1795093	N/A
Directional coupler	Werlatone	C8060-102	2149	N/A
DC Power Supply	AMETEK	XT 20-3	1318A00530	N/A
Synthesized Signal Generator	HP	8665B	3744A01155	3/12/2015
Power Meter	Agilent	N1911A	MY53060016	8/7/2015
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1795092	N/A
Directional coupler	Werlatone	C8060-102	2141	N/A
DC Power Supply	BK PRECISION	1611	215-02292	N/A
E-Field Probe (SAR LAB B)	SPEAG	EX3DV4	3749	1/29/2015
E-Field Probe (SAR LAB E)	SPEAG	EX3DV3	3990	4/15/2015
E-Field Probe (SAR LAB G)	SPEAG	EX3DV4	3901	2/25/2015
Data Acquisition Electronics (SAR LAB B)	SPEAG	DAE3	500	5/15/2015
Data Acquisition Electronics (SAR LAB E)	SPEAG	DAE4	1434	4/14/2015
Data Acquisition Electronics (SAR LAB G)	SPEAG	DAE4	1357	2/17/2015
System Validation Dipole	SPEAG	D750V3	1024	5/16/2015
System Validation Dipole	SPEAG	D835V2	4d117	5/16/2015
System Validation Dipole	SPEAG	D1750V2	1077	9/11/2015
System Validation Dipole	SPEAG	D1900V2	5d043	11/7/2015
System Validation Dipole	SPEAG	D2450V2	706	5/20/2015

Others

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Power Meter	Agilent	N1911A	MY53060016	8/7/2015
Power Sensor	Agilent	E9323A	MY53070003	5/1/2015
Base Station Simulator	R & S	CMW500	135390-W5	7/3/2015
Base Station Simulator	R & S	CMW500	135387-nG	7/8/2015

5. Measurement Uncertainty

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

6. Device Under Test (DUT) Information

6.1. DUT Description

GSM/WCDMA/LTE PHONE + BLUETOOTH, & DTS b/g/n	
Device Dimension	Overall (Length x Width): 129.9 mm x 64.1 mm Overall Diagonal: 140 mm Display Diagonal: 115 mm
Battery Back Cover	☒ Normal Battery Cover ☐ Normal Battery Cover with NFC ☐ Wireless Charger Battery Cover ☐ Wireless Charger Battery Cover with NFC ☐ The rechargeable battery is not user accessible.
Battery Options	☒ Standard – Lithium-ion battery, Rating 3.8Vdc, 7.2Wh ☐ Extended (large capacity) ☐ The rechargeable battery is not user accessible.
Accessory	Headset
Wireless Router (Hotspot)	Wi-Fi Hotspot mode permits the device to share its cellular data connection with other Wi-Fi-enabled devices. ☐ Mobile Hotspot (Wi-Fi 2.4 GHz)
Wi-Fi Direct	Wi-Fi Direct enabled devices transfer data directly between each other ☒ Wi-Fi Direct (Wi-Fi 2.4 GHz)

6.2. Wireless Technologies

Wireless technologies	**Frequency bands**	**Operating mode**	**Duty Cycle used for SAR testing**
GSM	850 1900	Voice (GMSK) GPRS (GMSK) EGPRS (8PSK)	GSM Voice: 12.5%; (E)GPRS: 1 Slot: 12.5%; 2 Slots: 25%,
	GPRS Multi-Slot Class: ☐ Class 8 - One Up ☒ Class 10 - Two Up ☐ Class 12 - Four Up ☐ Class 33 - Four Up DTM (Dual Transfer Mode): Not support		
	Does this device SV-DO (1xRTT-1xEVDO)? ☐Yes ☒ No		
W-CDMA (UMTS)	Band II Band V	UMTS Rel. 99 (Voice & Data) HSDPA (Rel. 7) HSUPA (Rel. 6) HSPA+ (Rel. 6)	100%
LTE (FDD)	Band 2 Band 4 Band 5 Band 17	QPSK 16QAM	100%
	Does this device SV-LTE (1xRTT-LTE)? ☐Yes ☒ No		
Wi-Fi	2.4 GHz	802.11b 802.11g 802.11n (HT20)	100%
Bluetooth	2.4 GHz	Version 4.0 LE	N/A

6.3. Nominal and Maximum Output Power

KDB 447498 sec.4.1.(3) at the maximum rated output power and within the tune-up tolerance range specified for the product, but not more than 2 dB lower than the maximum tune-up tolerance limit

Upper limit (dB): -1.5 ~ 0.5		RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit
GSM850	Voice	33.2	**33.7**
	GPRS 1 slot	33.2	**33.7**
	GPRS 2 slots	31.2	**31.7**
	EGPRS 1 slot	27.2	**27.7**
	EGPRS 2 slots	25.2	**25.7**
GSM1900	Voice	30.2	**30.7**
	GPRS 1 slot	30.2	**30.7**
	GPRS 2 slots	29.2	**29.7**
	EGPRS 1 slot	26.2	**26.7**
	EGPRS 2 slots	24.2	**24.7**
W-CDMA Band V	R99	23.7	**24.2**
	HSDPA	23.7	**24.2**
	HSUPA	23.7	**24.2**
W-CDMA Band II	R99	23.7	**24.2**
	HSDPA	23.7	**24.2**
	HSUPA	23.7	**24.2**
LTE Band 2	QPSK	23.7	**24.2**
LTE Band 4	QPSK	23.7	**24.2**
LTE Band 5	QPSK	23.7	**24.2**
LTE Band 17	QPSK	23.7	**24.2**

Upper limit (dB): -1.5 ~ 0.5		RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit
WiFi 2.4 GHz	802.11b	14.5	**15.5**
	802.11g	10.5	**11.5**
	802.11n HT20	9.5	**10.5**
Bluetooth		7.5	**8.5**
Bluetooth LE		-0.5	**0.5**

6.4. 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 rowspan="3">Band 2</td><td colspan="6">Frequency range: 1850 - 1910 MHz</td></tr>
<tr><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>18650/ 1855</td><td>18625/ 1852.5</td><td></td><td></td></tr>
<tr><td>Mid</td><td></td><td></td><td>18900/ 1880</td><td>18900/ 1880</td><td></td><td></td></tr>
<tr><td>High</td><td></td><td></td><td>19150/ 1905</td><td>19175/ 1907.5</td><td></td><td></td></tr>
<tr><td rowspan="3">Band 4</td><td colspan="6">Frequency range: 1710 - 1755 MHz</td></tr>
<tr><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/ 1715</td><td>19975/ 1712.5</td><td></td><td></td></tr>
<tr><td>Mid</td><td></td><td></td><td>20175/ 1732.5</td><td>20175/ 1732.5</td><td></td><td></td></tr>
<tr><td>High</td><td></td><td></td><td>20350/ 1750</td><td>20375/ 1752.5</td><td></td><td></td></tr>
<tr><td rowspan="3">Band 5</td><td colspan="6">Frequency range: 824 - 849 MHz</td></tr>
<tr><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>20450/ 829</td><td>20425/ 826.5</td><td></td><td></td></tr>
<tr><td>Mid</td><td></td><td></td><td>20525/ 836.5</td><td>20525/ 836.5</td><td></td><td></td></tr>
<tr><td>High</td><td></td><td></td><td>20600/ 844</td><td>20625/ 846.5</td><td></td><td></td></tr>
<tr><td rowspan="3">Band 17</td><td colspan="6">Frequency range: 704 - 716 MHz</td></tr>
<tr><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></td><td>23755/ 706.5</td><td></td><td></td></tr>
<tr><td>Mid</td><td></td><td></td><td>23790/ 710</td><td>23790/ 710</td><td></td><td></td></tr>
<tr><td>High</td><td></td><td></td><td></td><td>23825/ 713.5</td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>LTE transmitter and antenna implementation</td><td>LTE has two TX antennas and two RX antennas
Refer to Appendix A...</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>No</td></tr>
<tr><td>Spectrum plots for RB configurations</td><td>A properly configured base station 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>

7. RF Exposure Conditions (Test Configurations)

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

Wireless technologies	RF Exposure Conditions	DUT-to-User Separation	Test Position	Antenna-to-edge/surface	SAR Required	Note
WWAN ANT. 4	Head	0 mm	Left Touch	N/A	Yes	
			Left Tilt (15°)	N/A	Yes	
			Right Touch	N/A	Yes	
			Right Tilt (15°)	N/A	Yes	
	Body	15 mm	Rear	N/A	Yes	2
			Front	N/A	Yes	2
	Hotspot	10 mm	Rear	< 25 mm	Yes	
			Front	< 25 mm	Yes	
			Edge 1 (Top)	> 25 mm	No	1
			Edge 2 (Right)	< 25 mm	Yes	
			Edge 3 (Bottom)	< 25 mm	Yes	
			Edge 4 (Left)	> 25 mm	No	1
WWAN ANT. 5	Head	0 mm	Left Touch	N/A	Yes	
			Left Tilt (15°)	N/A	Yes	
			Right Touch	N/A	Yes	
			Right Tilt (15°)	N/A	Yes	
	Body	15 mm	Rear	N/A	Yes	2
			Front	N/A	Yes	2
	Hotspot	10 mm	Rear	< 25 mm	Yes	
			Front	< 25 mm	Yes	
			Edge 1 (Top)	> 25 mm	No	1
			Edge 2 (Right)	> 25 mm	No	1
			Edge 3 (Bottom)	< 25 mm	Yes	
			Edge 4 (Left)	< 25 mm	Yes	
WLAN	Head	0 mm	Left Touch	N/A	Yes	
			Left Tilt (15°)	N/A	Yes	
			Right Touch	N/A	Yes	
			Right Tilt (15°)	N/A	Yes	
	Body	15 mm	Rear	N/A	Yes	2
			Front	N/A	Yes	2
	Hotspot / Wi-Fi Direct	10 mm	Rear	< 25 mm	Yes	
			Front	< 25 mm	Yes	
			Edge 1 (Top)	< 25 mm	Yes	
			Edge 2 (Right)	< 25 mm	Yes	
			Edge 3 (Bottom)	> 25 mm	No	1
			Edge 4 (Left)	> 25 mm	No	1

Notes:

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

8. Dielectric Property Measurements & System Check

8.1. Dielectric Property Measurements

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

Tissue Dielectric Parameters

FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

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

IEEE Std 1528-2013

Refer to Table 3 within the IEEE Std 1528-2013

Dielectric Property Measurements Results:

SAR Lab B

	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
12/15/2014	Head 2450	e'	38.1900	Relative Permittivity (ϵ_r):	38.19	39.20	-2.58	5
		e''	13.1100	Conductivity (σ):	1.79	1.80	-0.78	5
	Head 2410	e'	38.0000	Relative Permittivity (ϵ_r):	38.00	39.28	-3.26	5
		e''	12.8400	Conductivity (σ):	1.72	1.76	-2.26	5
	Head 2475	e'	38.3200	Relative Permittivity (ϵ_r):	38.32	39.17	-2.17	5
		e''	13.1300	Conductivity (σ):	1.81	1.83	-1.10	5
12/15/2014	Body 2450	e'	51.1000	Relative Permittivity (ϵ_r):	51.10	52.70	-3.04	5
		e''	14.0200	Conductivity (σ):	1.91	1.95	-2.06	5
	Body 2410	e'	51.3000	Relative Permittivity (ϵ_r):	51.30	52.76	-2.77	5
		e''	13.6500	Conductivity (σ):	1.83	1.91	-4.11	5
	Body 2475	e'	51.1100	Relative Permittivity (ϵ_r):	51.11	52.67	-2.96	5
		e''	14.1400	Conductivity (σ):	1.95	1.99	-1.98	5

SAR Lab E

	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
12/10/2014	Head 1900	e'	38.7700	Relative Permittivity (ϵ_r):	38.77	40.00	-3.07	5
		e''	13.6500	Conductivity (σ):	1.44	1.40	3.00	5
	Head 1850	e'	38.9500	Relative Permittivity (ϵ_r):	38.95	40.00	-2.62	5
		e''	13.4700	Conductivity (σ):	1.39	1.40	-1.03	5
	Head 1910	e'	38.7800	Relative Permittivity (ϵ_r):	38.78	40.00	-3.05	5
		e''	13.7100	Conductivity (σ):	1.46	1.40	4.00	5
12/10/2014	Body 1900	e'	51.7300	Relative Permittivity (ϵ_r):	51.73	53.30	-2.95	5
		e''	14.5400	Conductivity (σ):	1.54	1.52	1.06	5
	Body 1850	e'	51.8000	Relative Permittivity (ϵ_r):	51.80	53.30	-2.81	5
		e''	14.4400	Conductivity (σ):	1.49	1.52	-2.28	5
	Body 1910	e'	51.7100	Relative Permittivity (ϵ_r):	51.71	53.30	-2.98	5
		e''	14.5500	Conductivity (σ):	1.55	1.52	1.66	5
12/15/2014	Body 1900	e'	52.7500	Relative Permittivity (ϵ_r):	52.75	53.30	-1.03	5
		e''	14.7800	Conductivity (σ):	1.56	1.52	2.73	5
	Body 1850	e'	54.0400	Relative Permittivity (ϵ_r):	54.04	53.30	1.39	5
		e''	14.6700	Conductivity (σ):	1.51	1.52	-0.72	5
	Body 1910	e'	52.5700	Relative Permittivity (ϵ_r):	52.57	53.30	-1.37	5
		e''	14.9000	Conductivity (σ):	1.58	1.52	4.11	5
12/15/2014	Head 1900	e'	39.6600	Relative Permittivity (ϵ_r):	39.66	40.00	-0.85	5
		e''	13.4500	Conductivity (σ):	1.42	1.40	1.50	5
	Head 1850	e'	41.3800	Relative Permittivity (ϵ_r):	41.38	40.00	3.45	5
		e''	13.1400	Conductivity (σ):	1.35	1.40	-3.45	5
	Head 1910	e'	39.3800	Relative Permittivity (ϵ_r):	39.38	40.00	-1.55	5
		e''	13.7300	Conductivity (σ):	1.46	1.40	4.15	5
12/16/2014	Head 1750	e'	40.9500	Relative Permittivity (ϵ_r):	40.95	40.08	2.16	5
		e''	13.6900	Conductivity (σ):	1.33	1.37	-2.69	5
	Head 1710	e'	41.0000	Relative Permittivity (ϵ_r):	41.00	40.15	2.13	5
		e''	13.5500	Conductivity (σ):	1.29	1.35	-4.31	5
	Head 1755	e'	40.9600	Relative Permittivity (ϵ_r):	40.96	40.08	2.20	5
		e''	13.7100	Conductivity (σ):	1.34	1.37	-2.47	5
12/16/2014	Body 1750	e'	51.6900	Relative Permittivity (ϵ_r):	51.69	53.44	-3.28	5
		e''	15.8900	Conductivity (σ):	1.55	1.49	4.04	5
	Body 1710	e'	51.8800	Relative Permittivity (ϵ_r):	51.88	53.54	-3.11	5
		e''	15.6100	Conductivity (σ):	1.48	1.46	1.55	5
	Body 1755	e'	51.6900	Relative Permittivity (ϵ_r):	51.69	53.43	-3.25	5
		e''	15.9200	Conductivity (σ):	1.55	1.49	4.32	5

SAR Lab G

	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
12/10/2014	Body 835	e'	52.5000	Relative Permittivity (ε_r):	52.50	55.20	-4.89	5
		e''	21.3200	Conductivity (σ):	0.99	0.97	2.05	5
	Body 820	e'	52.5600	Relative Permittivity (ε_r):	52.56	55.28	-4.92	5
		e''	21.3600	Conductivity (σ):	0.97	0.97	0.56	5
	Body 850	e'	52.4100	Relative Permittivity (ε_r):	52.41	55.16	-4.98	5
		e''	21.2900	Conductivity (σ):	1.01	0.99	1.93	5
12/10/2014	Head 835	e'	40.3300	Relative Permittivity (ε_r):	40.33	41.50	-2.82	5
		e''	19.5200	Conductivity (σ):	0.91	0.90	0.70	5
	Head 820	e'	40.4900	Relative Permittivity (ε_r):	40.49	41.60	-2.67	5
		e''	19.5600	Conductivity (σ):	0.89	0.90	-0.74	5
	Head 850	e'	40.1400	Relative Permittivity (ε_r):	40.14	41.50	-3.28	5
		e''	19.4300	Conductivity (σ):	0.92	0.92	0.36	5
12/17/2014	Head 835	e'	40.5700	Relative Permittivity (ε_r):	40.57	41.50	-2.24	5
		e''	19.9500	Conductivity (σ):	0.93	0.90	2.92	5
	Head 820	e'	41.0100	Relative Permittivity (ε_r):	41.01	41.60	-1.42	5
		e''	19.8900	Conductivity (σ):	0.91	0.90	0.94	5
	Head 850	e'	40.0800	Relative Permittivity (ε_r):	40.08	41.50	-3.42	5
		e''	20.1800	Conductivity (σ):	0.95	0.92	4.24	5
12/17/2014	Body 835	e'	54.3700	Relative Permittivity (ε_r):	54.37	55.20	-1.50	5
		e''	21.7600	Conductivity (σ):	1.01	0.97	4.15	5
	Body 820	e'	54.4700	Relative Permittivity (ε_r):	54.47	55.28	-1.46	5
		e''	21.7900	Conductivity (σ):	0.99	0.97	2.59	5
	Body 850	e'	54.2700	Relative Permittivity (ε_r):	54.27	55.16	-1.61	5
		e''	21.7500	Conductivity (σ):	1.03	0.99	4.14	5
12/18/2014	Body 710	e'	56.5000	Relative Permittivity (ε_r):	56.50	55.70	1.44	5
		e''	23.7800	Conductivity (σ):	0.94	0.96	-2.21	5
	Body 700	e'	56.7700	Relative Permittivity (ε_r):	56.77	55.74	1.85	5
		e''	23.9100	Conductivity (σ):	0.93	0.96	-2.98	5
	Body 720	e'	56.2000	Relative Permittivity (ε_r):	56.20	55.66	0.97	5
		e''	23.7100	Conductivity (σ):	0.95	0.96	-1.20	5
12/18/2014	Head 710	e'	41.2200	Relative Permittivity (ε_r):	41.22	42.17	-2.25	5
		e''	22.1000	Conductivity (σ):	0.87	0.89	-1.97	5
	Head 700	e'	41.4200	Relative Permittivity (ε_r):	41.42	42.22	-1.89	5
		e''	22.0500	Conductivity (σ):	0.86	0.89	-3.49	5
	Head 720	e'	41.1700	Relative Permittivity (ε_r):	41.17	42.12	-2.24	5
		e''	22.2800	Conductivity (σ):	0.89	0.89	0.13	5
12/23/2014	Head 835	e'	42.7600	Relative Permittivity (ε_r):	42.76	41.50	3.04	5
		e''	19.0200	Conductivity (σ):	0.88	0.90	-1.88	5
	Head 820	e'	42.8650	Relative Permittivity (ε_r):	42.87	41.60	3.03	5
		e''	18.9700	Conductivity (σ):	0.86	0.90	-3.73	5
	Head 850	e'	42.6326	Relative Permittivity (ε_r):	42.63	41.50	2.73	5
		e''	19.0800	Conductivity (σ):	0.90	0.92	-1.45	5

8.2. System Check

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

System Performance Check Measurement Conditions:

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

Reference Target SAR Values

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

System Dipole	Serial No.	Cal. Date	Freq. (MHz)	Target SAR Values (W/kg)		
				1g/10g	Head	Body
D750V3	1024	5/16/2014	750	1g	8.12	8.77
				10g	5.26	5.79
D835V2	4d117	5/16/2014	835	1g	9.23	9.61
				10g	5.98	6.31
D1750V2	1077	9/11/2014	1750	1g	36.5	36.9
				10g	19.4	19.8
D1900V2	5d043	11/7/2014	1900	1g	40.6	40.0
				10g	21.1	21.3
D2450V2	706	5/20/2014	2450	1g	53.0	50.2
				10g	24.5	23.4

System Check Results

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

SAR Lab B

Date Tested	System Dipole		T.S. Liquid		Measured Results		Target (Ref. Value)	Delta ±10 %	Plot No.
	Type	Serial #			Zoom Scan to 100 mW	Normalize to 1 W			
12/15/2014	D2450V2	706	Head	1g	5.14	51.4	53.0	-3.02	1,2
				10g	2.34	23.4	24.5	-4.49	
12/15/2014	D2450V2	706	Body	1g	4.88	48.8	50.20	-2.79	
				10g	2.24	22.4	23.4	-4.27	

SAR Lab E

Date Tested	System Dipole		T.S. Liquid		Measured Results		Target (Ref. Value)	Delta ±10 %	Plot No.
	Type	Serial #			Zoom Scan to 100 mW	Normalize to 1 W			
12/10/2014	D1900V2	5d043	Head	1g	3.82	38.2	40.6	-5.91	3, 4
				10g	1.96	19.6	21.1	-7.11	
12/10/2014	D1900V2	5d043	Body	1g	3.84	38.4	40.00	-3.93	
				10g	2.00	20.0	21.3	-6.10	
12/15/2014	D1900V2	5d043	Head	1g	4.17	41.7	40.6	2.71	
				10g	2.14	21.4	21.1	1.42	
12/15/2014	D1900V2	5d043	Body	1g	3.92	39.2	40.00	-2.00	
				10g	2.03	20.3	21.3	-4.69	
12/16/2014	D1750V2	1077	Head	1g	3.53	35.3	36.5	-3.29	5, 6
				10g	1.87	18.7	19.4	-3.61	
12/16/2014	D1750V2	1077	Body	1g	3.69	36.9	36.9	0.00	
				10g	1.97	19.7	19.8	-0.51	

SAR Lab G

Date Tested	System Dipole		T.S. Liquid		Measured Results		Target (Ref. Value)	Delta ±10 %	Plot No.
	Type	Serial #			Zoom Scan to 100 mW	Normalize to 1 W			
12/10/2014	D835V2	4d117	Head	1g	0.93	9.3	9.23	1.19	
				10g	0.61	6.1	5.98	2.01	
12/10/2014	D835V2	4d117	Body	1g	1.01	10.1	9.61	5.10	
				10g	0.66	6.6	6.31	5.23	
12/17/2014	D835V2	4d117	Head	1g	0.94	9.4	9.23	1.84	
				10g	0.62	6.2	5.98	3.01	
12/17/2014	D835V2	4d117	Body	1g	1.01	10.1	9.61	5.10	7, 8
				10g	0.67	6.7	6.31	5.55	
12/18/2014	D750V3	1024	Head	1g	0.87	8.7	8.12	7.14	9, 10
				10g	0.57	5.7	5.26	7.98	
12/18/2014	D750V3	1024	Body	1g	0.91	9.1	8.77	3.99	
				10g	0.61	6.1	5.79	5.18	
12/23/2014	D835V2	4d117	Head	1g	0.93	9.3	9.23	0.87	
				10g	0.61	6.1	5.98	1.84	

9. Conducted Output Power Measurements

9.1. GSM

GSM850 Measured Results

Band	Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Burst Pwr (dBm)	Frame Pwr (dBm)
850	GSM (Voice)	CS1	1	128	824.2	33.5	24.5
				190	836.6	33.5	24.5
				251	848.8	33.5	24.5
	GPRS (GMSK)	CS1	1	128	824.2	33.5	24.5
				190	836.6	33.5	24.5
				251	848.8	33.5	24.5
			2	128	824.2	31.0	25.0
				190	836.6	31.2	25.2
				251	848.8	31.2	25.2
	EGPRS (8PSK)	MCS5	1	128	824.2	27.5	18.5
				190	836.6	27.5	18.5
				251	848.8	27.5	18.5
			2	128	824.2	25.7	19.7
				190	836.6	25.6	19.6
				251	848.8	25.5	19.5

Notes:

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

- Head & Body-worn Accessory: GMSK Voice Mode
- Hotspot mode: GMSK (GPRS) mode with 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

GSM1900 Measured Results

Band	Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Burst Pwr (dBm)	Frame Pwr (dBm)
1900	GSM (Voice)	CS1	1	512	1850.2	30.5	21.5
				661	1880.0	30.5	21.5
				810	1909.8	30.5	21.5
	GPRS (GMSK)	CS1	1	512	1850.2	30.5	21.5
				661	1880.0	30.5	21.5
				810	1909.8	30.5	21.5
			2	512	1850.2	29.2	23.2
				661	1880.0	29.2	23.2
				810	1909.8	29.1	23.1
	EGPRS (8PSK)	MCS5	1	512	1850.2	26.4	17.4
				661	1880.0	26.5	17.5
				810	1909.8	26.4	17.4
			2	512	1850.2	24.4	18.4
				661	1880.0	24.5	18.5
				810	1909.8	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
- Hotspot mode: GMSK (GPRS) 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. W-CDMA

Release 99 Setup Procedures used to establish the test signals

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 2
	Rel99 RMC	12.2kbps RMC
	Power Control Algorithm	Algorithm2
	βc/βd	8/15

HSDPA Setup Procedures used to establish the test signals

The following 4 Sub-tests were completed according to Release 7 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-Set 1			
	Power Control Algorithm	Algorithm 2			
	βc	2/15	11/15	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			

HSPA (HSDPA & HSUPA) Setup Procedures used to establish the test signals

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				
	Subtest	1	2	3	4	5
WCDMA General Settings	Loopback Mode	Test Mode 1				
	Rel99 RMC	12.2 kbps RMC				
	HSDPA FRC	H-Set 1				
	HSUPA Test	HSPA				
	Power Control Algorithm	Algorithm 2				Algorithm 1
	βc	11/15	6/15	15/15	2/15	15/15
	βd	15/15	15/15	9/15	15/15	0
	βec	209/225	12/15	30/15	2/15	5/15
	βc/βd	11/15	6/15	15/9	2/15	15/1
	βhs	22/15	12/15	30/15	4/15	5/15
	βed	1309/225	94/75	47/15	56/75	47/15
	CM (dB)	1	3	2	3	1
	MPR (dB)	0	2	1	2	0
HSDPA Specific Settings	DACK	8				0
	DNAK	8				0
	DCQI	8				0
	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	E-DPDCCH	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	5	5	2	5	1
	Reference E-TFCI	11	11	11	11	67
	Reference E-TFCI PO	4	4	4	4	18
	Reference E-TFCI	67	67	92	67	67
	Reference E-TFCI PO	18	18	18	18	18
	Reference E-TFCI	71	71	71	71	71
	Reference E-TFCI PO	23	23	23	23	23
	Reference E-TFCI	75	75	75	75	75
	Reference E-TFCI PO	26	26	26	26	26
	Reference E-TFCI	81	81	81	81	81
	Reference E-TFCI PO	27	27	27	27	27
	Maximum Channelisation Codes	2xSF2				SF4

HSPA+

Since 16QAM is not used for uplink, the uplink Category and release is same as HSUPA, i.e., CAT 6 Rel 6. Therefore, the RF conducted power is not measured.

Measured Results

Band	Mode		UL Ch No.	Freq. (MHz)	MPR (dB)	Avg Pwr (dBm)
W-CDMA Band II	Rel 99	RMC, 12.2 kbps	9262	1852.4	N/A	23.9
			9400	1880.0	N/A	23.8
			9538	1907.6	N/A	23.9
	HSDPA	Subtest 1	9262	1852.4	0	23.0
			9400	1880.0	0	23.0
			9538	1907.6	0	23.1
		Subtest 2	9262	1852.4	0	23.1
			9400	1880.0	0	23.1
			9538	1907.6	0	23.1
		Subtest 3	9262	1852.4	0.5	22.5
			9400	1880.0	0.5	22.5
			9538	1907.6	0.5	22.5
		Subtest 4	9262	1852.4	0.5	22.6
			9400	1880.0	0.5	22.5
			9538	1907.6	0.5	22.6
	HSUPA	Subtest 1	9262	1852.4	0	22.4
			9400	1880.0	0	22.6
			9538	1907.6	0	22.4
		Subtest 2	9262	1852.4	2	21.4
			9400	1880.0	2	21.8
			9538	1907.6	2	21.8
		Subtest 3	9262	1852.4	1	21.9
			9400	1880.0	1	21.9
			9538	1907.6	1	21.5
		Subtest 4	9262	1852.4	2	22.0
			9400	1880.0	2	22.2
			9538	1907.6	2	22.2
		Subtest 5	9262	1852.4	0	23.0
			9400	1880.0	0	23.1
			9538	1907.6	0	23.2

Measured Results

Band	Mode		UL Ch No.	Freq. (MHz)	MPR (dB)	Avg Pwr (dBm)
W-CDMA Band V	Rel 99	RMC, 12.2 kbps	4132	826.4	N/A	23.9
			4183	836.6	N/A	23.8
			4233	846.6	N/A	23.9
	HSDPA	Subtest 1	4132	826.4	0	22.8
			4183	836.6	0	22.8
			4233	846.6	0	22.9
		Subtest 2	4132	826.4	0	22.5
			4183	836.6	0	22.5
			4233	846.6	0	22.3
		Subtest 3	4132	826.4	0.5	21.8
			4183	836.6	0.5	21.7
			4233	846.6	0.5	21.7
		Subtest 4	4132	826.4	0.5	21.9
			4183	836.6	0.5	21.9
			4233	846.6	0.5	21.8
	HSUPA	Subtest 1	4132	826.4	0	22.3
			4183	836.6	0	23.0
			4233	846.6	0	23.0
		Subtest 2	4132	826.4	2	21.8
			4183	836.6	2	21.9
			4233	846.6	2	22.2
		Subtest 3	4132	826.4	1	22.2
			4183	836.6	1	22.1
			4233	846.6	1	21.6
		Subtest 4	4132	826.4	2	22.1
			4183	836.6	2	22.2
			4233	846.6	2	22.1
		Subtest 5	4132	826.4	0	23.0
			4183	836.6	0	23.2
			4233	846.6	0	23.0

9.3. LTE

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 2 Measured Results

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							1855 MHz	1880 MHz	1905 MHz
LTE Band 2	10	QPSK	1	0	0	0	23.9	24.0	23.9
			1	25	0	0	23.8	23.9	23.7
			1	49	0	0	23.8	23.9	23.8
			25	0	1	1	22.8	23.0	22.8
			25	12	1	1	22.7	23.0	22.8
			25	25	1	1	22.8	22.9	22.8
			50	0	1	1	22.8	22.9	22.7
		16QAM	1	0	1	1	22.8	22.8	23.0
			1	25	1	1	22.8	22.8	23.1
			1	49	1	1	22.7	23.0	23.0
			25	0	2	2	22.0	21.9	22.0
			25	12	2	2	21.9	22.0	22.0
			25	25	2	2	21.6	21.8	21.9
			50	0	2	2	21.5	21.7	21.9
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							1852.5 MHz	1880 MHz	1907.5 MHz
LTE Band 2	5	QPSK	1	0	0	0	23.6	23.9	23.8
			1	12	0	0	23.7	24.2	24.0
			1	24	0	0	23.6	23.9	23.7
			12	0	1	1	22.7	23.0	22.8
			12	6	1	1	22.8	22.9	22.7
			12	11	1	1	22.8	23.0	22.7
			25	0	1	1	22.8	23.0	22.8
		16QAM	1	0	1	1	22.2	22.4	23.0
			1	12	1	1	22.2	22.9	23.0
			1	24	1	1	22.2	23.1	23.0
			12	0	2	2	21.9	22.0	22.0
			12	6	2	2	21.8	21.7	21.9
			12	11	2	2	21.7	22.0	21.8
			25	0	2	2	22.0	21.9	21.9

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	24.2	24.2	24.2
			1	25	0	0	24.2	24.2	24.2
			1	49	0	0	24.1	24.2	24.2
			25	0	1	1	23.1	23.0	23.2
			25	12	1	1	23.0	23.0	23.2
			25	25	1	1	23.1	23.0	23.1
			50	0	1	1	23.0	23.0	23.2
		16QAM	1	0	1	1	23.2	23.0	22.9
			1	25	1	1	23.0	22.7	22.8
			1	49	1	1	22.9	22.7	22.3
			25	0	2	2	22.1	21.9	22.2
			25	12	2	2	22.0	22.0	22.2
			25	25	2	2	22.0	22.1	22.2
			50	0	2	2	22.0	21.9	22.1
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	23.8	23.9	24.0
			1	12	0	0	24.0	24.0	24.2
			1	24	0	0	23.8	23.8	24.0
			12	0	1	1	22.9	22.8	23.2
			12	6	1	1	22.9	22.9	23.1
			12	11	1	1	22.9	23.0	23.0
			25	0	1	1	22.9	22.9	23.1
		16QAM	1	0	1	1	23.2	22.8	23.2
			1	12	1	1	23.2	22.6	23.1
			1	24	1	1	23.2	22.4	23.2
			12	0	2	2	22.0	21.7	22.2
			12	6	2	2	21.9	21.7	22.2
			12	11	2	2	21.9	22.0	22.2
			25	0	2	2	21.9	22.2	22.0

LTE Band 5 Measured Results

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							829 MHz	836.5 MHz	844 MHz
LTE Band 5	10	QPSK	1	0	0	0	24.1	24.1	23.9
			1	25	0	0	23.8	23.9	23.9
			1	49	0	0	23.9	23.9	23.8
			25	0	1	1	22.7	22.7	22.7
			25	12	1	1	22.7	22.7	22.7
			25	25	1	1	22.7	22.7	22.7
			50	0	1	1	22.7	22.7	22.7
		16QAM	1	0	1	1	22.8	23.0	23.0
			1	25	1	1	22.8	22.6	22.8
			1	49	1	1	22.7	22.4	22.9
			25	0	2	2	22.0	21.6	21.9
			25	12	2	2	21.9	21.7	21.9
			25	25	2	2	21.6	21.7	21.8
			50	0	2	3	21.5	21.6	21.6
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							826.5 MHz	836.5 MHz	846.5 MHz
LTE Band 5	5	QPSK	1	0	0	0	23.8	23.7	23.7
			1	12	0	0	23.8	23.6	23.7
			1	24	0	0	23.6	23.7	23.5
			12	0	1	1	22.8	22.6	22.6
			12	6	1	1	22.7	22.7	22.6
			12	11	1	1	22.6	22.6	22.7
			25	0	1	1	22.7	22.7	22.6
		16QAM	1	0	1	1	23.0	22.5	22.4
			1	12	1	1	22.6	22.7	22.5
			1	24	1	1	22.5	22.8	22.3
			12	0	2	2	21.7	21.9	21.7
			12	6	2	2	21.8	21.8	21.4
			12	11	2	2	21.7	21.8	21.6
			25	0	2	2	21.9	21.8	21.6

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	24.2
			1	25	0	0	24.2
			1	49	0	0	24.1
			25	0	1	1	23.2
			25	12	1	1	23.2
			25	25	1	1	23.2
			50	0	1	1	23.2
		16QAM	1	0	1	1	23.0
			1	25	1	1	23.2
			1	49	1	1	23.2
			25	0	2	2	21.9
			25	12	2	2	22.0
			25	25	2	2	21.9
			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	24.1
			1	12	0	0	24.2
			1	24	0	0	23.8
			12	0	1	2	22.7
			12	6	1	2	22.7
			12	11	1	2	22.7
			25	0	1	2	22.7
		16QAM	1	0	1	2	22.6
			1	12	1	2	22.6
			1	24	1	2	22.6
			12	0	2	2	22.0
			12	6	2	2	22.1
			12	11	2	2	22.0
			25	0	2	2	21.8

Note(s):

10/5 MHz Bandwidths does not support at least three non-overlapping channels in certain channel bandwidths. When a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing per KDB 941225 D05 SAR for LTE Devices

9.4. Wi-Fi DTS (2.4 GHz) Band

Required Test Channels per KDB 248227 D01

Measured Results

Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	Avg Pwr (dBm)	SAR Test (Yes/No)
2.4	802.11b	1 Mbps	1	2412	14.6	Yes
			6	2437	14.7	
			11	2462	14.7	
	802.11g	6 Mbps	1	2412	10.4	No
			6	2437	10.4	
			11	2462	10.8	
	802.11n (HT20)	MCS0	1	2412	9.3	No
			6	2437	9.4	
			11	2462	9.7	

Note(s):

Per KDB 248227 D01 v02:

1. Output Power and SAR measurement is not required for 802.11g/n HT20 channels when the specified tune-up tolerances for 802.11g/n HT20 are lower than 802.11b by more than 1 dB and the measured SAR is ≤ 1.2 W/Kg.
2. A second channel is tested because the *reported* SAR is > 0.8 W/kg. A third channel is tested because the *reported* SAR is > 1.2 W/kg.

9.5. Bluetooth

Maximum tune-up tolerance limit is 8.5 dBm from the rated nominal maximum output power. This power level qualifies for exclusion of SAR testing.

10. Measured and Reported (Scaled) SAR Results

SAR Test Reduction criteria are as follows:

KDB 447498 D01 General RF Exposure Guidance:

Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:

- ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
- ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
- ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz

KDB 648474 D04 Handset SAR:

With headset attached, when the reported SAR for body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.

KDB 941225 D01 SAR test for 3G devices:

Body SAR is also measured for HSPA when the maximum average output of each RF channel with HSPA active is at least ¼ dB higher than that measured without HSPA using 12.2 kbps RMC or the maximum SAR for 12.2 kbps RMC is above 75% of the SAR limit. Body SAR for HSPA is measured with E-DCH Sub-test 5, using H-Set 1 and QPSK for FRC and a 12.2 kbps RMC configured in Test Loop Mode 1 with power control algorithm 2.

KDB 941225 D05 SAR for LTE Devices:

SAR test reduction is applied using the following criteria:

- Start with the largest channel bandwidth and measure SAR for QPSK with 1 RB, and 50% RB allocation, using the RB offset and required test channel combination with the highest maximum output power among RB offsets at the upper edge, middle and lower edge of each required test channel.
- When the reported SAR is > 0.8 W/kg, testing for other Channels 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.

KDB 248227 D01 SAR Measurements Procedures for 802.11 a/b/g Transmitters v02 (pg.6):

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

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

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

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

10.1. GSM850

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Voice	0	Left Touch	190	836.6	33.7	33.5	0.523	0.548	
			Left Tilt	190	836.6	33.7	33.5	0.389	0.407	
			Right Touch	190	836.6	33.7	33.5	0.667	0.698	1
			Right Tilt	190	836.6	33.7	33.5	0.406	0.425	
Head VoIP	GPRS 2 Slots	0	Left Touch	190	836.6	31.7	31.2	0.592	0.664	
			Left Tilt	190	836.6	31.7	31.2	0.422	0.473	
			Right Touch	128	824.2	31.7	31.0	0.698	0.820	
				190	836.6	31.7	31.2	0.720	0.808	
				251	848.8	31.7	31.2	0.737	0.827	2
			Right Tilt	190	836.6	31.7	31.2	0.447	0.502	
Body-worn	Voice	10	Rear	190	836.6	33.7	33.5	0.626	0.656	
			Front	190	836.6	33.7	33.5	0.733	0.768	3
Body-worn(VoIP) & Hotspot	GPRS 2 Slots	10	Rear	128	824.2	31.7	31.0	0.807	0.948	4
				190	836.6	31.7	31.2	0.713	0.800	
				251	848.8	31.7	31.2	0.637	0.715	
			Front	128	824.2	31.7	31.0	0.736	0.865	
				190	836.6	31.7	31.2	0.774	0.868	
				251	848.8	31.7	31.2	0.683	0.766	
Hotspot			Edge 2	190	836.6	31.7	31.2	0.655	0.735	
			Edge 3	190	836.6	31.7	31.2	0.248	0.278	

10.2. GSM1900

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Voice	0	Left Touch	661	1880.0	30.7	30.5	0.442	0.463	5
			Left Tilt	661	1880.0	30.7	30.5	0.089	0.093	
			Right Touch	661	1880.0	30.7	30.5	0.242	0.253	
			Right Tilt	661	1880.0	30.7	30.5	0.086	0.090	
Head VoIP	GPRS 2 Slots	0	Left Touch	661	1880.0	29.2	29.2	0.664	0.664	6
			Left Tilt	661	1880.0	29.2	29.2	0.131	0.131	
			Right Touch	661	1880.0	29.2	29.2	0.361	0.361	
			Right Tilt	661	1880.0	29.2	29.2	0.133	0.133	
Body-worn	Voice	10	Rear	661	1880.0	30.7	30.5	0.522	0.547	7
			Front	661	1880.0	30.7	30.5	0.500	0.524	
Body-worn(VoIP) & Hotspot	GPRS 2 Slots	10	Rear	512	1850.2	29.2	29.2	0.835	0.835	8
				661	1880.0	29.2	29.2	0.809	0.809	
				810	1909.8	29.2	29.1	0.804	0.823	
			Front	661	1880.0	29.2	29.2	0.722	0.722	
Hotspot			Edge 3	661	1880.0	29.2	29.2	0.561	0.561	
			Edge 4	661	1880.0	29.2	29.2	0.343	0.343	

10.3. W-CDMA Band V

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Rel 99 RMC	0	Left Touch	4183	836.6	24.2	23.8	0.426	0.467	
			Left Tilt	4183	836.6	24.2	23.8	0.234	0.257	
			Right Touch	4183	836.6	24.2	23.8	0.490	0.537	9
			Right Tilt	4183	836.6	24.2	23.8	0.252	0.276	
Body-worn & Hotspot	Rel 99 RMC	10	Rear	4183	836.6	24.2	23.8	0.530	0.581	10
			Front	4183	836.6	24.2	23.8	0.456	0.500	
Hotspot	Rel 99 RMC	10	Edge 2	4183	836.6	24.2	23.8	0.435	0.477	
			Edge 3	4183	836.6	24.2	23.8	0.181	0.198	

10.4. 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	0	Left Touch	9400	1880.0	24.2	24.1	0.653	0.676	11
			Left Tilt	9400	1880.0	24.2	24.1	0.145	0.150	
			Right Touch	9400	1880.0	24.2	24.1	0.386	0.400	
			Right Tilt	9400	1880.0	24.2	24.1	0.183	0.189	
Body-worn & Hotspot	Rel 99 RMC	10	Rear	9262	1852.4	24.2	24.1	0.763	0.790	
				9400	1880.0	24.2	24.1	0.774	0.801	
				9538	1907.6	24.2	24.1	0.791	0.819	
			Front	9262	1852.4	24.2	24.1	0.792	0.820	
				9400	1880.0	24.2	24.1	0.802	0.830	
				9538	1907.6	24.2	24.1	0.827	0.856	12
Hotspot	Rel 99 RMC	10	Edge 3	9400	1880.0	24.2	24.1	0.555	0.575	
			Edge 4	9400	1880.0	24.2	24.1	0.352	0.364	

10.5. LTE Band 2 (10MHz Bandwidth)

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	RB Allocation	RB offest	Power (dBm)		1-g SAR (W/kg)		Plot No.
								Tune-up limit	Meas.	Meas.	Scaled	
Head	QPSK	0	Left Touch	18900	1880.0	1	0	24.2	24.0	0.751	0.786	13
						25	0	23.2	23.0	0.532	0.557	
			Left Tilt	18900	1880.0	1	0	24.2	24.0	0.224	0.235	
						25	0	23.2	23.0	0.156	0.163	
			Right Touch	18900	1880.0	1	0	24.2	24.0	0.482	0.505	
						25	0	23.2	23.0	0.318	0.333	
			Right Tilt	18900	1880.0	1	0	24.2	24.0	0.236	0.247	
						25	0	23.2	23.0	0.172	0.180	
Body-worn & Hotspot	QPSK	10	Rear	18650	1855.0	1	0	24.2	23.9	0.952	1.020	
				18900	1880.0	1	0	24.2	24.0	1.010	1.058	
						25	0	23.2	23.0	0.753	0.788	
				19150	1905.0	1	0	24.2	23.9	1.040	1.114	14
			Front	18650	1855.0	1	0	24.2	23.9	0.927	0.993	
				18900	1880.0	1	0	24.2	24.0	0.959	1.004	
						25	0	23.2	23.0	0.734	0.769	
				19150	1905.0	1	0	24.2	23.9	1.000	1.072	
Hotspot	QPSK	10	Edge 3	18900	1880.0	1	0	24.2	24.0	0.569	0.596	
						25	0	23.2	23.0	0.431	0.451	
			Edge 4	18900	1880.0	1	0	24.2	24.0	0.473	0.495	
						25	0	23.2	23.0	0.344	0.360	

10.6. LTE Band 4 (10MHz Bandwidth)

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	RB Allocation	RB offest	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	24.2	0.720	0.720	
						25	0	23.2	23.2	0.539	0.539	
			Left Tilt	20175	1732.5	1	0	24.2	24.2	0.147	0.147	
						25	0	23.2	23.2	0.096	0.096	
			Right Touch	20175	1732.5	1	0	24.2	24.2	0.793	0.793	15
						25	0	23.2	23.2	0.574	0.574	
			Right Tilt	20175	1732.5	1	0	24.2	24.2	0.165	0.165	
						25	0	23.2	23.2	0.118	0.118	
Body-worn & Hotspot	QPSK	10	Rear	20000	1720.0	1	0	24.2	24.2	1.040	1.040	
				20175	1732.5	1	0	24.2	24.2	1.050	1.050	
						25	0	23.2	23.2	0.795	0.795	
				20350	1750.0	1	0	24.2	24.2	1.160	1.160	16
			Front	20000	1720.0	1	0	24.2	24.2	1.150	1.150	
						25	0	23.2	23.1	0.856	0.876	
				20175	1732.5	1	0	24.2	24.2	1.100	1.100	
						25	0	23.2	23.2	0.822	0.822	
						50	0	23.2	23.0	0.838	0.877	
				20350	1750.0	1	0	24.2	24.2	1.070	1.070	
						25	0	23.2	23.2	0.845	0.845	
Hotspot	QPSK	10	Edge 3	20175	1732.5	1	0	24.2	24.2	0.744	0.744	
						25	0	23.2	23.2	0.504	0.504	
			Edge 4	20175	1732.5	1	0	24.2	24.2	0.504	0.504	
						25	0	23.2	23.2	0.365	0.365	

10.7. LTE Band 5 (10MHz Bandwidth)

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	RB Allocation	RB offest	Power (dBm)		1-g SAR (W/kg)		Plot No.
								Tune-up limit	Meas.	Meas.	Scaled	
Head	QPSK	0	Left Touch	20525	836.5	1	0	24.2	24.1	0.509	0.521	17
						25	0	23.2	22.8	0.377	0.413	
			Left Tilt	20525	836.5	1	0	24.2	24.1	0.298	0.305	
						25	0	23.2	22.8	0.213	0.234	
			Right Touch	20525	836.5	1	0	24.2	24.1	0.496	0.508	
						25	0	23.2	22.8	0.381	0.418	
			Right Tilt	20525	836.5	1	0	24.2	24.1	0.306	0.313	
						25	0	23.2	22.8	0.212	0.232	
Body-worn & Hotspot	QPSK	10	Rear	20525	836.5	1	0	24.2	24.1	0.543	0.556	18
						25	0	23.2	22.8	0.411	0.451	
			Front	20525	836.5	1	0	24.2	24.1	0.533	0.545	
						25	0	23.2	22.8	0.408	0.447	
Hotspot	QPSK	10	Edge 2	20525	836.5	1	0	24.2	24.1	0.523	0.535	
						25	0	23.2	22.8	0.386	0.423	
			Edge 3	20525	836.5	1	0	24.2	24.1	0.210	0.215	
						25	0	23.2	22.8	0.158	0.173	

10.8. LTE Band 17 (10MHz Bandwidth)

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	RB Allocation	RB offest	Power (dBm)		1-g SAR (W/kg)		Plot No.
								Tune-up limit	Meas.	Meas.	Scaled	
Head	QPSK	0	Left Touch	23790	710.0	1	0	24.2	24.2	0.268	0.268	
						25	0	23.2	23.2	0.184	0.184	
			Left Tilt	23790	710.0	1	0	24.2	24.2	0.187	0.187	
						25	0	23.2	23.2	0.116	0.116	
			Right Touch	23790	710.0	1	0	24.2	24.2	0.384	0.384	19
						25	0	23.2	23.2	0.268	0.268	
			Right Tilt	23790	710.0	1	0	24.2	24.2	0.199	0.199	
						25	0	23.2	23.2	0.135	0.135	
Body-worn & Hotspot	QPSK	10	Rear	23790	710.0	1	0	24.2	24.2	0.868	0.868	20
						25	0	23.2	23.2	0.626	0.626	
			Front	23790	710.0	1	0	24.2	24.2	0.438	0.438	
						25	0	23.2	23.2	0.315	0.315	
Hotspot	QPSK	10	Edge 2	23790	710.0	1	0	24.2	24.2	0.613	0.613	
						25	0	23.2	23.2	0.422	0.422	
			Edge 3	23790	710.0	1	0	24.2	24.2	0.112	0.112	
						25	0	23.2	23.2	0.075	0.075	

10.9. Wi-Fi (DTS Band)

Frequency Band	RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Power (dBm)		1-g SAR (W/kg)		Plot No.
								Tune-up limit	Meas.	Meas.	Scaled	
2.4GHz	Head	802.11b 1 Mbps	0	Left Touch	6	2437.0	0.352	15.5	14.7	0.296	0.356	21
				Left Tilt	6	2437.0	0.321					
				Right Touch	6	2437.0	0.295					
				Right Tilt	6	2437.0	0.265					
	Body-worn & Wi-Fi Direct	802.11b 1 Mbps	10	Rear	6	2437.0	0.092	15.5	14.7	0.076	0.091	22
				Front	6	2437.0	0.091					
	Wi-Fi Direct	802.11b 1 Mbps	10	Edge 1	6	2437.0	0.085					
				Edge 2	6	2437.0	0.040					

10.10. Bluetooth

Standalone SAR Test Exclusion Considerations & Estimated SAR

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

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

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

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

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

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

Body-worn Accessory Exposure Conditions

Max. tune-up tolerance limit		Min. test separation distance (mm)	Frequency (GHz)	SAR test exclusion Result*	Test Configuration	Estimated 1-g SAR (W/kg)
(dBm)	(mW)					
8.5	7	10	2.480	1.1	Rear/Front	0.149

Conclusion:

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

11. SAR Measurement Variability

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

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

Frequency Band (MHz)	Air Interface	RF Exposure Conditions	Test Position	Repeated SAR (Yes/No)	Highest Measured SAR (W/kg)	Repeated Measured SAR (W/kg)	Largest to Smallest SAR Ratio
700	LTE Band 17	Body & Hotspot	Rear	Yes	0.868	0.817	1.06
850	GSM 850	Body & Hotspot	Rear	Yes	0.807	0.805	1.00
	WCDMA Band V	Body & Hotspot	Rear	No	0.530	N/A	N/A
	LTE Band 5	Head	RHS Touch	No	0.599	N/A	N/A
1900	GSM 1900	Body & Hotspot	Rear	No	0.835	N/A	N/A
	WCDMA Band II	Body & Hotspot	Rear	No	0.827	N/A	N/A
	LTE Band 2	Body & Hotspot	Rear	Yes	1.04	1.03	1.01
1700	LTE Band 4	Body & Hotspot	Rear	Yes	1.16	1.09	1.06
2400	Wi-Fi 802.11b/g/n	Head	LHS Touch	No	0.356	N/A	N/A

Note(s):

Second Repeated Measurement is not required since the ratio of the largest to smallest SAR for the original and first repeated measurement is not > 1.20.

12. Simultaneous Transmission SAR Analysis

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

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

Where:

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

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

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

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

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

Simultaneous Transmission Condition

RF Exposure Condition	Item	Capable Transmit Configurations		
Head	1	GSM(Voice)	+	Wi-Fi 2.4 GHz
	2	GSM(GPRS/EDGE)	+	Wi-Fi 2.4 GHz
	3	WCDMA	+	Wi-Fi 2.4 GHz
	4	LTE	+	Wi-Fi 2.4 GHz
Body-worn	1	GSM(Voice)	+	Wi-Fi 2.4 GHz
	2	GSM(Voice)	+	BT
	3	GSM(GPRS/EDGE)	+	Wi-Fi 2.4 GHz
	4	GSM(GPRS/EDGE)	+	BT
	5	WCDMA	+	Wi-Fi 2.4 GHz
	6	WCDMA	+	BT
	7	LTE	+	Wi-Fi 2.4 GHz
	8	LTE	+	BT
Hotspot & Wi-Fi Direct	1	GSM(GPRS/EDGE)	+	Wi-Fi 2.4 GHz
	2	WCDMA	+	Wi-Fi 2.4 GHz
	3	LTE	+	Wi-Fi 2.4 GHz

Notes:

1. Wi-Fi only 2.4GHz supports Wi-Fi direct
2. GPRS/EDGE, WCDMA, and LTE support Hotspot.
3. VoIP is supported in GPRS/EDGE, WCDMA and LTE.
4. Wi-Fi 2.4 GHz Radio cannot transmit simultaneously with Bluetooth Radio.

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

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario			∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① GSM850	② Wi-Fi(DTS)	③ Bluetooth		
Head	Left Touch	① + ②	0.548	0.356		0.904	No
Body-worn Accessory & Hotspot	Rear	① + ②	0.948	0.091		1.039	No
		① + ③	0.948		0.149	1.097	No
	Front	① + ③	0.868		0.149	1.017	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.

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

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario			∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① GSM1900	② Wi-Fi(DTS)	③ Bluetooth		
Head	Left Touch	① + ②	0.463	0.356		0.819	No
Body-worn Accessory & Hotspot	Rear	① + ②	0.835	0.091		0.926	No
		① + ③	0.835		0.149	0.984	No
	Front	① + ③	0.722		0.149	0.871	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.

12.3. Sum of the SAR for WCDMA Band V & Wi-Fi & BT

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario			∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① W-CDMA Band V	② Wi-Fi(DTS)	③ Bluetooth		
Head	Left Touch	① + ②	0.467	0.356		0.823	No
Body-worn Accessory & Hotspot	Rear	① + ②	0.581	0.091		0.672	No
		① + ③	0.581		0.149	0.730	No
	Front	① + ③	0.500		0.149	0.649	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.

12.4. Sum of the SAR for WCDMA Band II & Wi-Fi & BT

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario			∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① W-CDMA Band II	② Wi-Fi(DTS)	③ Bluetooth		
Head	Left Touch	① + ②	0.676	0.356		1.032	No
Body-worn Accessory & Hotspot	Rear	① + ②	0.819	0.091		0.910	No
		① + ③	0.819		0.149	0.968	No
	Front	① + ③	0.856		0.149	1.005	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.

12.5. Sum of the SAR for LTE Band 2 & Wi-Fi & BT

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario ① LTE Band 2	② Wi-Fi(DTS)	③ Bluetooth	∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)
Head	Left Touch	① + ②	0.786	0.356		1.142	No
Body-worn Accessory & Hotspot	Rear	① + ②	1.114	0.091		1.205	No
		① + ③	1.114		0.149	1.263	No
	Front	① + ③	1.072		0.149	1.221	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.

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

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario ① LTE Band 4	② Wi-Fi(DTS)	③ Bluetooth	∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)
Head	Left Touch	① + ②	0.720	0.356		1.076	No
Body-worn Accessory & Hotspot	Rear	① + ②	1.160	0.091		1.251	No
		① + ③	1.160		0.149	1.309	No
	Front	① + ③	1.150		0.149	1.299	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.

12.7. Sum of the SAR for LTE Band 5 & Wi-Fi & BT

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario ① LTE Band 5	② Wi-Fi(DTS)	③ Bluetooth	∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)
Head	Left Touch	① + ②	0.521	0.356		0.877	No
Body-worn Accessory & Hotspot	Rear	① + ②	0.556	0.093		0.649	No
		① + ③	0.556		0.149	0.705	No
	Front	① + ③	0.545		0.149	0.694	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.

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

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario ① LTE Band 17	② Wi-Fi(DTS)	③ Bluetooth	∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)
Head	Left Touch	① + ②	0.268	0.356		0.624	No
Body-worn Accessory & Hotspot	Rear	① + ②	0.868	0.091		0.959	No
		① + ③	0.868		0.149	1.017	No
	Front	① + ③	0.438		0.149	0.587	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.

Appendixes

Refer to separated files for the following appendixes.

A_14I19561v0 SAR Photos & Ant. Locations

B_14I19561v0 SAR Highest SAR Test Plots

C_14I19561v0 SAR System Check Plots

D_14I19561v0 SAR Tissue Ingredients

E_14I19561v0 SAR Probe Cal. Certificates

F_14I19561v0 SAR Dipole Cal. Certificates

END OF REPORT