SAR EVALUATION REPORT

FCC 47 CFR § 2.1093
IEEE Std 1528-2013

For
GSM/WCDMA/LTE Tablet + Bluetooth, DTS/UNII a/b/g/n & ANT+

FCC ID: A3LSMP355
Model Name: SM-P355, SM-T355Y

Report Number: 15I19962-S1A
Issue Date: 3/6/2015

Prepared for
SAMSUNG ELECTRONICS CO., LTD.
129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI
GYEONGGI-DO 443-742, SOUTH KOREA

Prepared by
UL VERIFICATION SERVICES INC.
47173 BENICIA STREET
FREMONT, CA 94538, U.S.A.
TEL: (510) 771-1000
FAX: (510) 661-0888

NVLAP LAB CODE 200065-0

Revision History

Rev.	Date	Revisions	Revised By
--	3/4/2015	Initial Issue	--
A	3/6/2015	Report revised based on Reviewer's comments: 1. Sec. 6.2.: Updated table	Kenneth Mak

This report shall not be reproduced without the written approval of UL Verification Services Inc.

Table of Contents

1. Attestation of Test Results 5

2. Test Specification, Methods and Procedures 6

3. Facilities and Accreditation 6

4. SAR Measurement System & Test Equipment 7

4.1. SAR Measurement System 7

4.2. SAR Scan Procedures 8

4.3. Test Equipment 10

5. Measurement Uncertainty 11

6. Device Under Test (DUT) Information 12

6.1. DUT Description 12

6.2. Wireless Technologies 12

6.3. Nominal and Maximum Output Power 13

6.4. General LTE SAR Test and Reporting Considerations 14

6.6. Power Reduction by Proximity Sensing 15

6.6.1. Proximity Sensor Triggering Distance (KDB 616217 §6.2) 15

6.6.2. Proximity Sensor Triggering Distance Measurement Results 16

6.6.3. Proximity Sensor Coverage (KDB 616217 §6.3) 30

6.6.4. Proximity Sensor Tilt Angle Assessment (KDB 616217 §6.4) 30

6.6.1. Resulting test positions for SAR measurements 31

7. RF Exposure Conditions (Test Configurations) 32

7.1. Standalone SAR Test Exclusion Considerations 32

7.2. Required Test Configurations 35

8. Dielectric Property Measurements & System Check 36

8.1. Dielectric Property Measurements 36

8.2. System Check 40

9. Conducted Output Power Measurements 44

9.1. GSM 44

9.2. W-CDMA 46

9.3. LTE 51

9.4. Wi-Fi 2.4GHz 53

9.5. Wi-Fi 5GHz 54

9.6. Bluetooth 55

10. Measured and Reported (Scaled) SAR Results 56

This report shall not be reproduced without the written approval of UL Verification Services Inc.

10.1. GSM850 58
10.2. GSM1900 58
10.3. W-CDMA Band V 59
10.4. W-CDMA Band II 59
10.5. LTE Band 5 (10MHz Bandwidth) 59
10.6. Wi-Fi (DTS Band) 60
10.7. Wi-Fi (U-NII Band) 60
10.8. Bluetooth 61

11. SAR Measurement Variability 62

12. Simultaneous Transmission SAR Analysis 63
12.1. Sum of the SAR for GSM850 & Wi-Fi & BT 65
12.2. Sum of the SAR for GSM1900 & Wi-Fi & BT 65
12.3. Sum of the SAR for WCDMA Band V & Wi-Fi & BT 66
12.4. Sum of the SAR for WCDMA Band II & Wi-Fi & BT 66
12.5. Sum of the SAR for LTE Band 5 & Wi-Fi & BT 66

Appendixes 67
A_15I19962v0 SAR Photos & Ant. Locations 67
B_15I19962v0 SAR Highest Test Plots 67
C_15I19962v0 SAR System Check Plots 67
D_15I19962v0 SAR Tissue Ingredients 67
E_15I19962v0 SAR Probe Cal. Certificates 67
F_15I19962v0 SAR Dipole Cal. Certificates 67

This report shall not be reproduced without the written approval of UL Verification Services Inc.

1. Attestation of Test Results

Applicant Name		SAMSUNG ELECTRONICS CO., LTD.			
FCC ID		A3LSMP355			
Model Name		SM-P355, SM-T355Y			
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		0.157	0.525	0.824	N/A
Body		1.095	0.367	0.489	0.426
Simultaneous Tx	Head	0.933	0.623	0.933	N/A
	Body	1.521	1.462	1.505	1.521
Date Tested		2/7/2015 to 2/26/2015			
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.	James Kim Laboratory Technician UL Verification Services Inc.

This report shall not be reproduced without the written approval of 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 802.11 v02
- 447498 D01 General RF Exposure Guidance v05r02
- 447498 D03 Supplement C Cross-Reference
- 616217 D04 SAR for laptop and tablets v01r01
- 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	

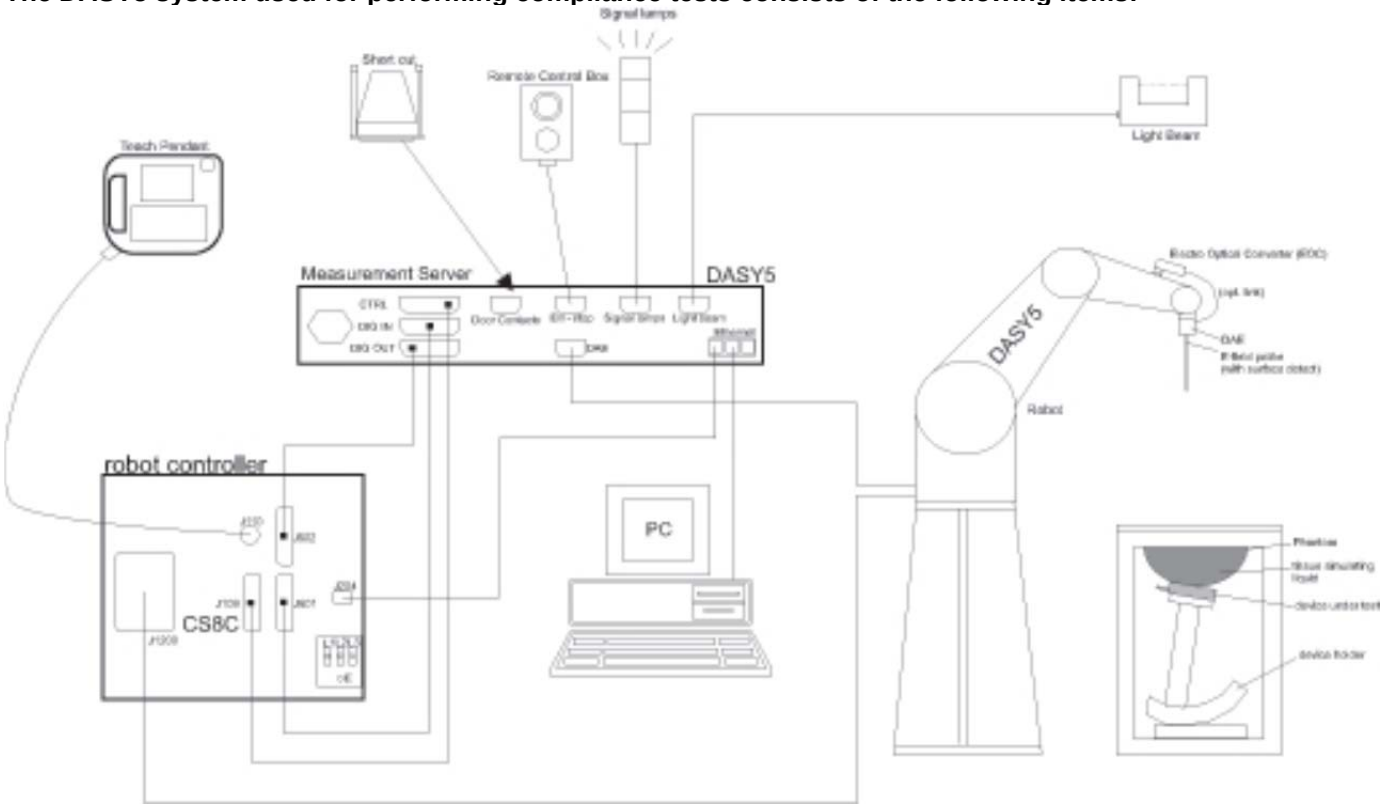
UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0.

This report shall not be reproduced without the written approval of UL Verification Services Inc.

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.

This report shall not be reproduced without the written approval of UL Verification Services Inc.

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

	≤ 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.	

This report shall not be reproduced without the written approval of UL Verification Services Inc.

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	$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$	
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.

This report shall not be reproduced without the written approval of UL Verification Services Inc.

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	8753ES	MY40001647	7/17/2015
Dielectronic Probe kit	SPEAG	DAK-3.5	1103	2/14/2016
Dielectronic Probe kit	SPEAG	DAK-3.5	1087	11/11/2015
Dielectronic Probe kit	SPEAG	DAK-3.5 Short	SM DAK 200 BA	N/A
Thermometer	Traceable Calibration Control Co.	4242	122529162	10/8/2015

System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Synthesized Signal Generator	HP	8665B	3744A01084	5/20/2015
Power Meter	Agilent	N1912A	MY53040016	5/5/2015
Power Sensor	Agilent	E9323A	MY53070005	5/1/2015
Power Sensor	Agilent	E9323A	MY53070009	5/28/2015
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1795093	N/A
Directional coupler	Werlatone	C8060-102	2149	N/A
DC Power Supply	AMETEK	XT 15-4	1319A02778	N/A
Synthesized Signal Generator	HP	8665B	3744A01155	3/12/2015
Power Meter	HP	437B	3125U11364	8/27/2015
Power Meter	HP	437B	3125U12345	8/15/2015
Power Sensor	HP	8481A	1926A27048	8/15/2015
Power Sensor	HP	8481A	2702A76223	9/17/2015
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	3751	11/14/2015
E-Field Probe (SAR Lab F)	SPEAG	EX3DV4	3936	7/24/2015
E-Field Probe (SAR Lab G)	SPEAG	EX3DV4	3990	4/15/2015
Data Acquisition Electronics (SAR Lab B)	SPEAG	DAE3	500	5/15/2015
Data Acquisition Electronics (SAR Lab F)	SPEAG	DAE4	1239	4/15/2015
Data Acquisition Electronics (SAR Lab G)	SPEAG	DAE4	1434	4/14/2015
System Validation Dipole	SPEAG	D835V2	4d117	5/16/2015
System Validation Dipole	SPEAG	D1900V2	5d043	11/7/2015
System Validation Dipole	SPEAG	D2450V2	706	5/20/2015
System Validation Dipole	SPEAG	D5GHzV2	1168	12/4/2015

Other

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Power Sensor	Agilent	N1921A	MY52200012	9/26/2015
Power Meter	Agilent	N1911A	MY53060009	5/5/2015
Power Sensor	Agilent	E9323A	MY53070003	5/1/2015
Base Station Simulator	R & S	CMW500	134855-bw	7/15/2015
Base Station Simulator	R & S	CMW500	134853-ud	7/17/2015
Base Station Simulator	R & S	CMU200	838114/032	7/30/2015

This report shall not be reproduced without the written approval of UL Verification Services Inc.

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.

This report shall not be reproduced without the written approval of UL Verification Services Inc.

6. Device Under Test (DUT) Information

6.1. DUT Description

Device Dimension	Overall (Length x Width): 209 mm x 139 mm Overall Diagonal: 242 mm Display Diagonal: 205 mm
Battery Back Cover	☒ The rechargeable battery is not user accessible.
Battery Options	☒ The rechargeable battery is not user accessible.
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) ☐ 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)

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)	GPRS Multi-Slot Class: ☐ Class 8 - One Up ☐ Class 10 - Two Up ☐ Class 12 - Four Up ☒ Class 33 - Four Up	GSM Voice: 12.5% (E)GPRS: 1 Slot: 12.5% 2 Slots: 25% 3 Slots: 37.5% 4 Slots: 50%
	Does this device support DTM (Dual Transfer Mode)? ☒ Yes ☐ No			
W-CDMA (UMTS)	Band II Band V	UMTS Rel. 99 (Voice & Data) HSDPA (Rel. 5) HSUPA (Rel. 6) DC-HSDPA (Rel. 8) HSPA+ (Rel. 6)		100%
LTE (FDD)	Band 5	QPSK 16QAM ☒ Does not support Carrier Aggregation (CA).		100%
	Does this device support SV-LTE (1xRTT-LTE)? ☐ Yes ☒ No			
Wi-Fi	2.4 GHz	802.11b 802.11g 802.11n (HT20)		100%
	5 GHz	802.11a 802.11n (HT20) 802.11n (HT40)		100%
	Does this device support bands 5.60 ~ 5.65 GHz? ☐ Yes ☒ No			
	Does this device support Band gap channel? ☐ Yes ☒ No			
Bluetooth	2.4 GHz	Version 4.1 LE		77.5% (DH5)

This report shall not be reproduced without the written approval of UL Verification Services Inc.

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		Max. RF Output Pow er (dBm)		Reduced RF Output Pow er (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit	Target	Max. tune-up tolerance limit
GSM850	Voice	32.5	**33.0**	28.5	**29.0**
	GPRS 1 slot	32.5	**33.0**	28.5	**29.0**
	GPRS 2 slots	31.0	**31.5**	25.5	**26.0**
	GPRS 3 slots	29.5	**30.0**	24.0	**24.5**
	GPRS 4 slots	28.0	**28.5**	22.5	**23.0**
	EGPRS 1 slot	27.0	**27.5**	26.0	**26.5**
	EGPRS 2 slots	25.5	**26.0**	26.0	**26.5**
	EGPRS 3 slots	23.5	**24.0**	24.0	**24.5**
	EGPRS 4 slots	22.0	**22.5**	23.0	**23.5**
GSM1900	Voice	29.5	**30.0**	21.5	**22.0**
	GPRS 1 slot	29.5	**30.0**	21.5	**22.0**
	GPRS 2 slots	28.0	**28.5**	17.0	**17.5**
	GPRS 3 slots	26.5	**27.0**	16.5	**17.0**
	GPRS 4 slots	25.0	**25.5**	15.5	**16.0**
	EGPRS 1 slot	25.5	**26.0**	21.0	**21.5**
	EGPRS 2 slots	24.5	**25.0**	16.0	**16.5**
	EGPRS 3 slots	23.0	**23.5**	16.0	**16.5**
	EGPRS 4 slots	21.5	**22.0**	15.0	**15.5**
W-CDMA Band V	R99	22.5	**23.0**	17.5	**18.0**
	HSDPA	22.5	**23.0**	17.5	**18.0**
	HSUPA	22.5	**23.0**	17.5	**18.0**
	DC-HSDPA	22.5	**23.0**	17.5	**18.0**
W-CDMA Band II	R99	22.5	**23.0**	12.0	**12.5**
	HSDPA	22.5	**23.0**	12.0	**12.5**
	HSUPA	22.5	**23.0**	12.0	**12.5**
	DC-HSDPA	22.5	**23.0**	12.0	**12.5**
LTE Band 5	QPSK	22.5	**23.0**	18.0	**18.5**

Upper limit (dB): 0.5		Max. RF Output Pow er (dBm)		Reduced RF Output Pow er (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit	Target	Max. tune-up tolerance limit
WiFi 2.4 GHz	802.11b	16.0	**16.5**	11.0	**11.5**
	802.11g	13.0	**13.5**	11.0	**11.5**
	802.11n HT20	12.0	**12.5**	11.0	**11.5**
WiFi 5 GHz	802.11a	11.0	**11.5**	6.0	**6.5**
	802.11n HT20	11.0	**11.5**	6.0	**6.5**
	802.11n HT40	9.0	**9.5**	6.0	**6.5**
Bluetooth		10.0	**10.5**	N/A	
Bluetooth LE		0.5	**1.0**	N/A	

This report shall not be reproduced without the written approval of UL Verification Services Inc.

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><th rowspan="3">Band 5</th><th colspan="6">Frequency range: 824 - 849 MHz</th></tr>
<tr><th colspan="6">Channel Bandwidth</th></tr>
<tr><th>20 MHz</th><th>15 MHz</th><th>10 MHz</th><th>5 MHz</th><th>3 MHz</th><th>1.4 MHz</th></tr>
<tr><td>Low</td><td></td><td></td><td>20450/ 829</td><td>20425/ 826.5</td><td>20415/ 825.5</td><td>20407/ 824.7</td></tr>
<tr><td>Mid</td><td></td><td></td><td>20525/ 836.5</td><td>20525/ 836.5</td><td>20525/ 836.5</td><td>20525/ 836.5</td></tr>
<tr><td>High</td><td></td><td></td><td>20600/ 844</td><td>20625/ 846.5</td><td>20635/ 847.5</td><td>20643/ 848.3</td></tr>
</table>
</td></tr>
<tr><td>LTE transmitter and antenna implementation</td><td>LTE has one (1) TX/RX antennas and one (1) 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>Yes</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>

This report shall not be reproduced without the written approval of UL Verification Services Inc.

6.6. Power Reduction by Proximity Sensing

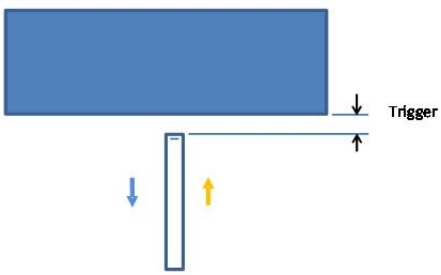
6.6.1. Proximity Sensor Triggering Distance (KDB 616217 §6.2)

Edge 1 of the DUT was placed directly below the flat phantom. The DUT was moved toward the phantom in accordance with the steps outlined in KDB 616217 §6.2 to determine the trigger distance for enabling power reduction. The DUT was moved away from the phantom to determine the trigger distance for resuming full power.

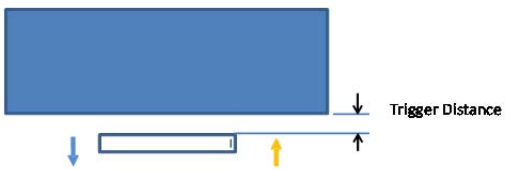
The measurement was then repeated for the Rear, Edge 2, and Edge 3 surface.

The DUT featured a visual indicator on its display that showed the status of the proximity sensor (Triggered or not triggered). This was used to determine the status of the sensor during the proximity sensor assessment as monitoring the output power directly was not practical without affecting the measurement.

It was confirmed separately that the output power was altered according to the proximity sensor status indication. This was achieved by observing the proximity sensor status at the same time as monitoring the conducted power. Section 9 contains both the full and reduced conducted power measurements.



Proximity Sensor Trigger Distance A ssessment
KDB 616217 §6.2 , Edge 1, 2, 3



Proximi ty Sensor Trigger Distance Assessment
KDB 616217 §6.2, Rear

LEGEND

→ Direction of DUT travel for determination of power reduction triggering point

→ Direction of DUT travel for determination of full power resumption triggering point

Summary of Trigger Distances for WWAN

Tissue simulating liquid	Trigger distance - Rear		Trigger distance – Edge 2		Trigger distance – Edge 3	
	Moving toward phantom	Moving from phantom	Moving from phantom	Moving toward phantom	Moving from phantom	Moving toward phantom
850 muscle	20mm	20mm	8mm	8mm	15mm	15mm
1900 muscle	20mm	20mm	8mm	8mm	15mm	15mm

Summary of Trigger Distances for Wi-Fi

Tissue simulating liquid	Trigger distance - Rear		Trigger distance – Edge 1	
	Moving toward phantom	Moving from phantom	Moving from phantom	Moving toward phantom
2450 muscle	13mm	13mm	11mm	11mm
5000 muscle	13mm	13mm	11mm	11mm

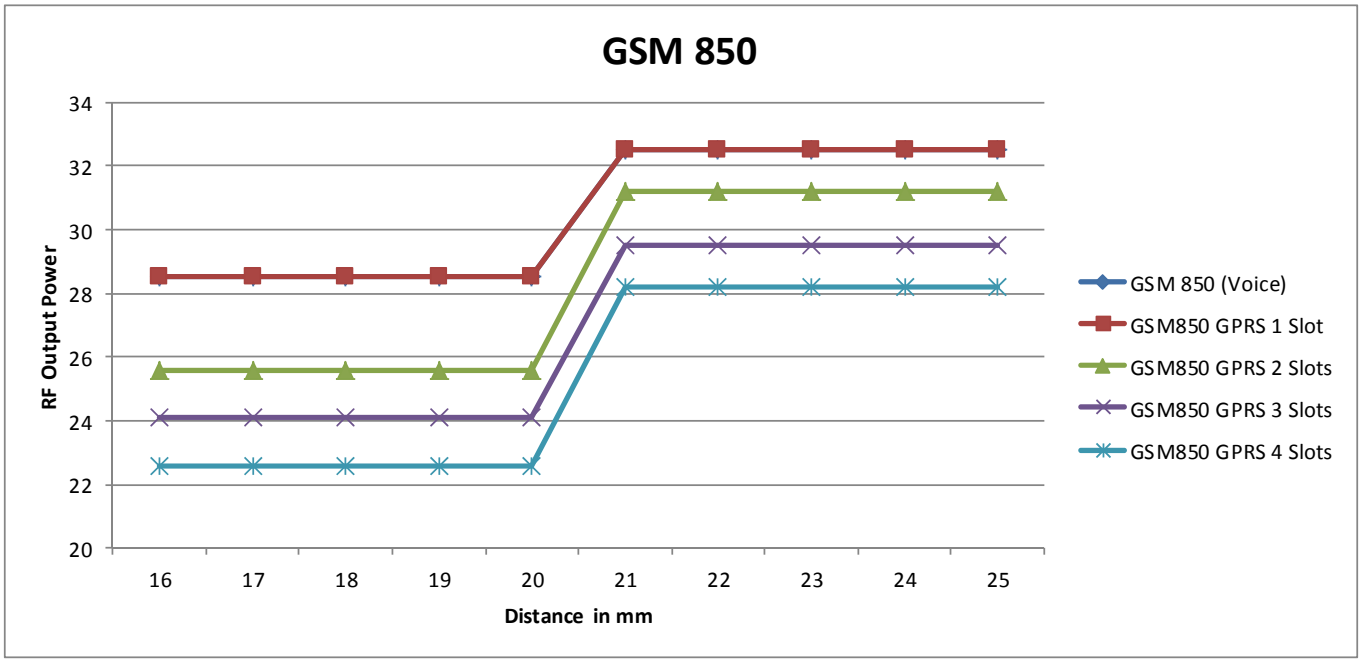
This report shall not be reproduced without the written approval of UL Verification Services Inc.

6.6.2. Proximity Sensor Triggering Distance Measurement Results

GSM850

Rear, DUT Moving Toward (Trigger) and Away (Release) from the Phantom

Distance to DUT vs. Output Power in dBm										
Distance (mm)	16	17	18	19	20	21	22	23	24	25
GSM 850 (Voice)	28.5	28.5	28.5	28.5	28.5	32.5	32.5	32.5	32.5	32.5
GSM850 GPRS 1 Slot	28.5	28.5	28.5	28.5	28.5	32.5	32.5	32.5	32.5	32.5
GSM850 GPRS 2 Slots	25.6	25.6	25.6	25.6	25.6	31.2	31.2	31.2	31.2	31.2
GSM850 GPRS 3 Slots	24.1	24.1	24.1	24.1	24.1	29.5	29.5	29.5	29.5	29.5
GSM850 GPRS 4 Slots	22.6	22.6	22.6	22.6	22.6	28.2	28.2	28.2	28.2	28.2

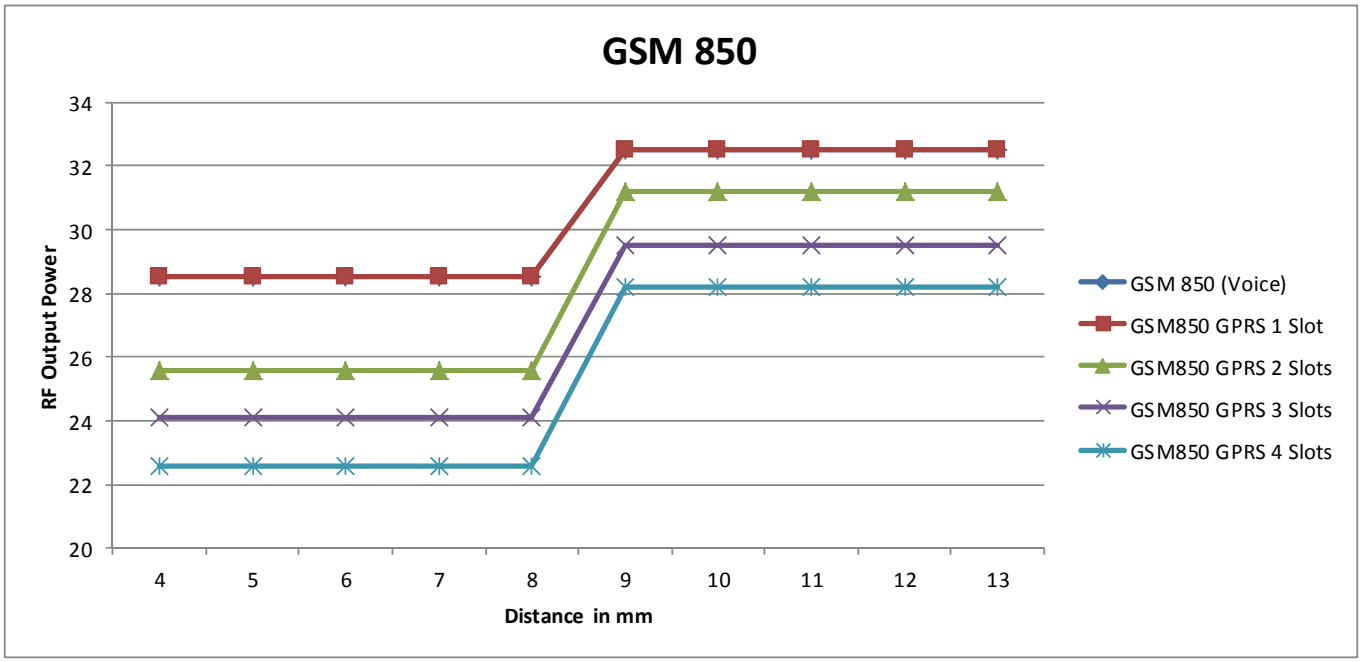


This report shall not be reproduced without the written approval of UL Verification Services Inc.

GSM850

Edge 2, DUT Moving Toward (Trigger) and Away (Release) from the Phantom

Distance to DUT vs. Output Power in dBm										
Distance (mm)	4	5	6	7	8	9	10	11	12	13
GSM 850 (Voice)	28.5	28.5	28.5	28.5	28.5	32.5	32.5	32.5	32.5	32.5
GSM850 GPRS 1 Slot	28.5	28.5	28.5	28.5	28.5	32.5	32.5	32.5	32.5	32.5
GSM850 GPRS 2 Slots	25.6	25.6	25.6	25.6	25.6	31.2	31.2	31.2	31.2	31.2
GSM850 GPRS 3 Slots	24.1	24.1	24.1	24.1	24.1	29.5	29.5	29.5	29.5	29.5
GSM850 GPRS 4 Slots	22.6	22.6	22.6	22.6	22.6	28.2	28.2	28.2	28.2	28.2

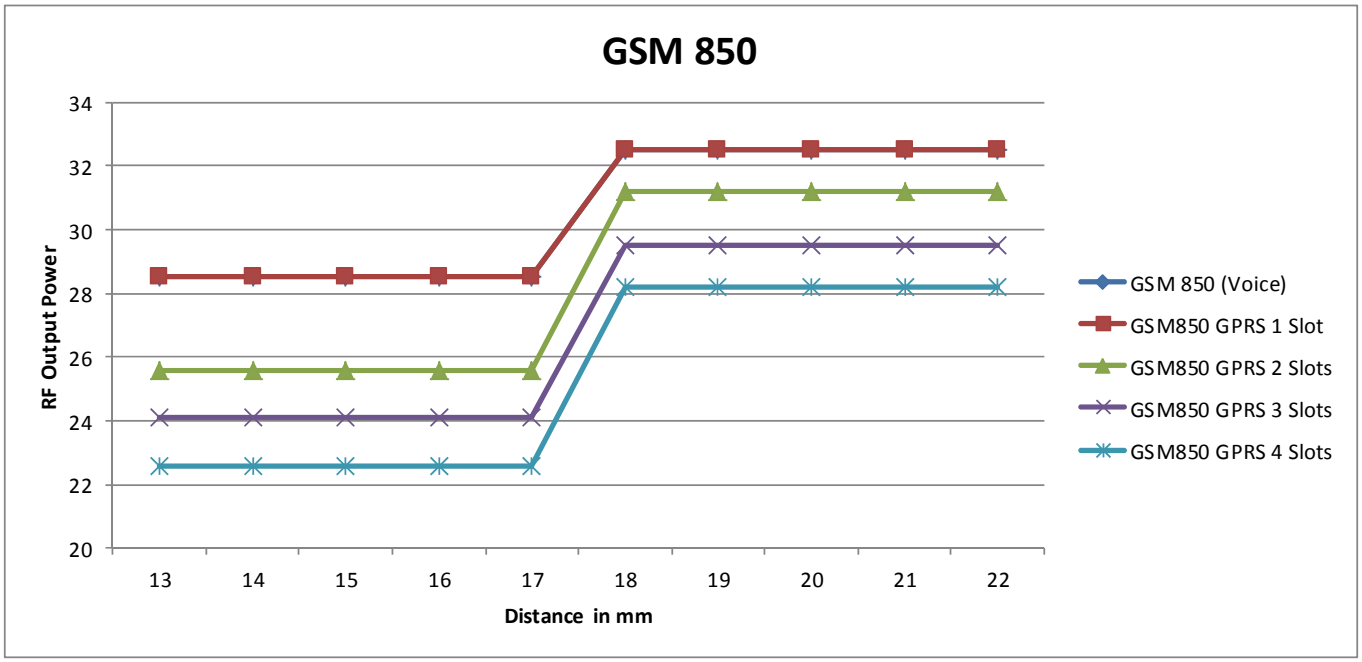


This report shall not be reproduced without the written approval of UL Verification Services Inc.

GSM850

Edge 3, DUT Moving Toward (Trigger) and Away (Release) from the Phantom

Distance to DUT vs. Output Power in dBm										
Distance (mm)	13	14	15	16	17	18	19	20	21	22
GSM 850 (Voice)	28.5	28.5	28.5	28.5	28.5	32.5	32.5	32.5	32.5	32.5
GSM850 GPRS 1 Slot	28.5	28.5	28.5	28.5	28.5	32.5	32.5	32.5	32.5	32.5
GSM850 GPRS 2 Slots	25.6	25.6	25.6	25.6	25.6	31.2	31.2	31.2	31.2	31.2
GSM850 GPRS 3 Slots	24.1	24.1	24.1	24.1	24.1	29.5	29.5	29.5	29.5	29.5
GSM850 GPRS 4 Slots	22.6	22.6	22.6	22.6	22.6	28.2	28.2	28.2	28.2	28.2

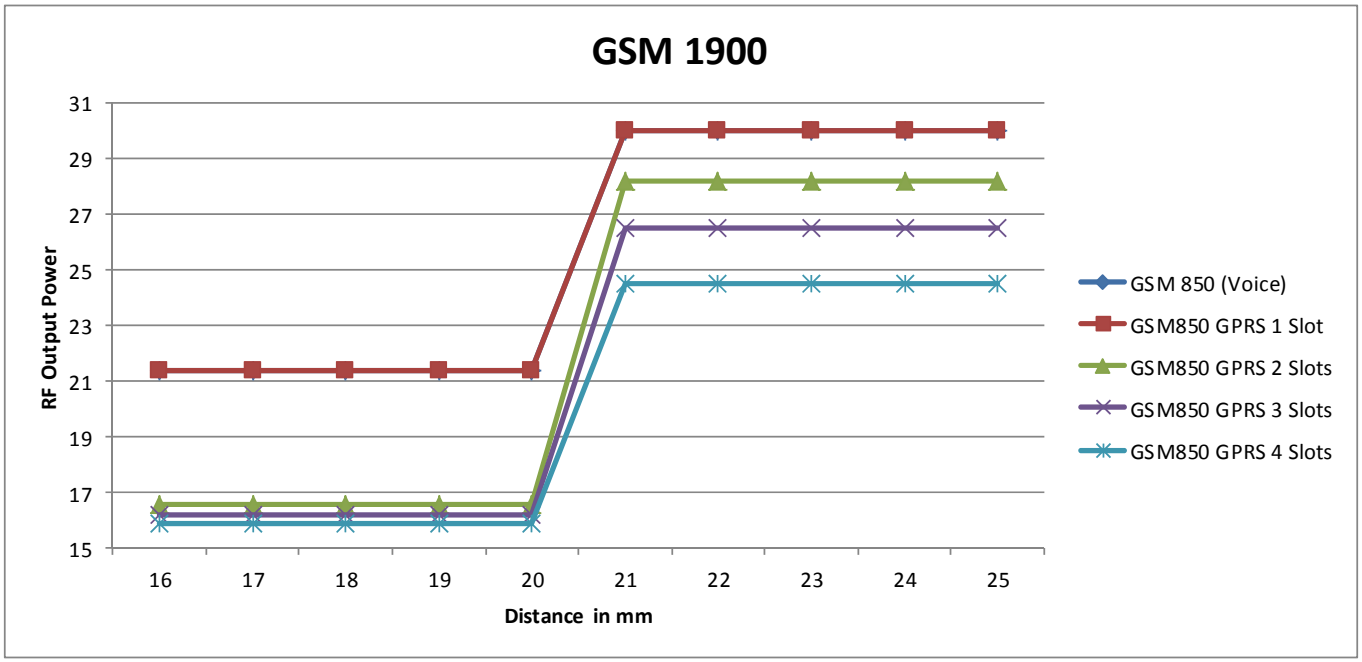


This report shall not be reproduced without the written approval of UL Verification Services Inc.

GSM1900d

Rear, DUT Moving Toward (Trigger) and Away (Release) from the Phantom

Distance to DUT vs. Output Power in dBm										
Distance (mm)	16	17	18	19	20	21	22	23	24	25
GSM 850 (Voice)	21.4	21.4	21.4	21.4	21.4	30.0	30.0	30.0	30.0	30.0
GSM850 GPRS 1 Slot	21.4	21.4	21.4	21.4	21.4	30.0	30.0	30.0	30.0	30.0
GSM850 GPRS 2 Slots	16.6	16.6	16.6	16.6	16.6	28.2	28.2	28.2	28.2	28.2
GSM850 GPRS 3 Slots	16.2	16.2	16.2	16.2	16.2	26.5	26.5	26.5	26.5	26.5
GSM850 GPRS 4 Slots	15.9	15.9	15.9	15.9	15.9	24.5	24.5	24.5	24.5	24.5

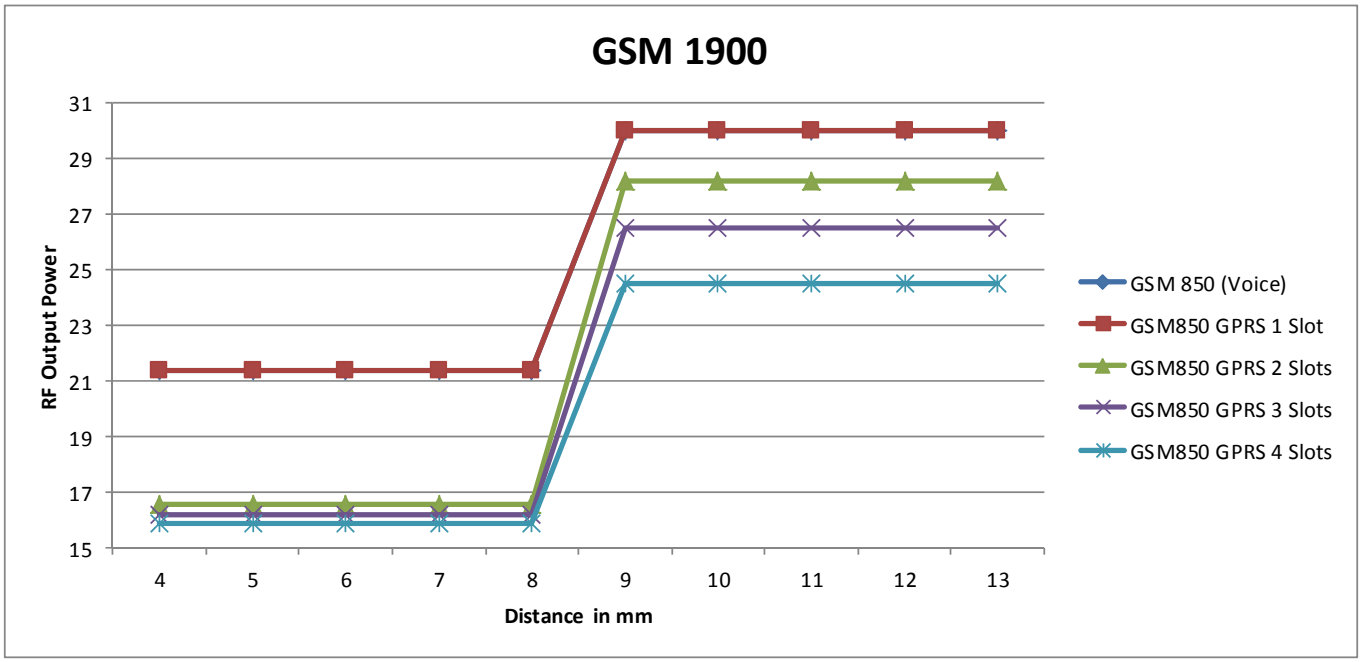


This report shall not be reproduced without the written approval of UL Verification Services Inc.

GSM1900

Edge 2, DUT Moving Toward (Trigger) and Away (Release) from the Phantom

Distance to DUT vs. Output Power in dBm										
Distance (mm)	4	5	6	7	8	9	10	11	12	13
GSM 850 (Voice)	21.4	21.4	21.4	21.4	21.4	30.0	30.0	30.0	30.0	30.0
GSM850 GPRS 1 Slot	21.4	21.4	21.4	21.4	21.4	30.0	30.0	30.0	30.0	30.0
GSM850 GPRS 2 Slots	16.6	16.6	16.6	16.6	16.6	28.2	28.2	28.2	28.2	28.2
GSM850 GPRS 3 Slots	16.2	16.2	16.2	16.2	16.2	26.5	26.5	26.5	26.5	26.5
GSM850 GPRS 4 Slots	15.9	15.9	15.9	15.9	15.9	24.5	24.5	24.5	24.5	24.5

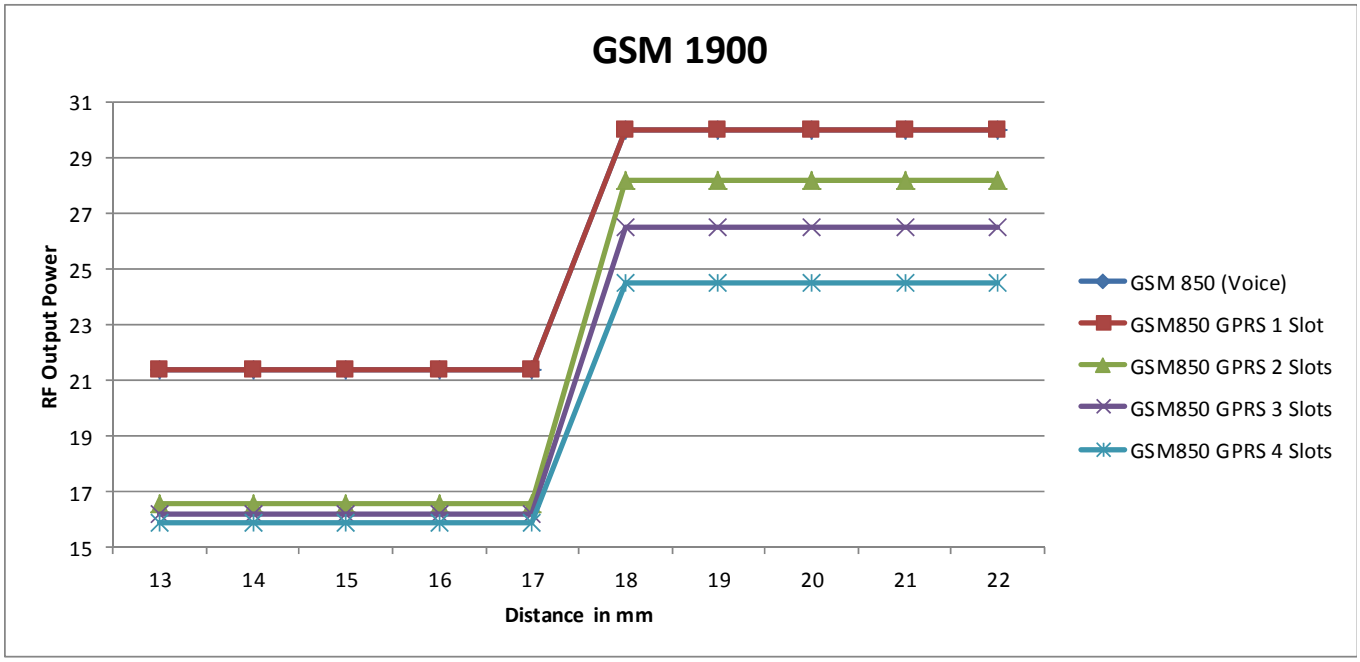


This report shall not be reproduced without the written approval of UL Verification Services Inc.

GSM1900

Edge 3, DUT Moving Toward (Trigger) and Away (Release) from the Phantom

Distance to DUT vs. Output Power in dBm										
Distance (mm)	13	14	15	16	17	18	19	20	21	22
GSM 850 (Voice)	21.4	21.4	21.4	21.4	21.4	30.0	30.0	30.0	30.0	30.0
GSM850 GPRS 1 Slot	21.4	21.4	21.4	21.4	21.4	30.0	30.0	30.0	30.0	30.0
GSM850 GPRS 2 Slots	16.6	16.6	16.6	16.6	16.6	28.2	28.2	28.2	28.2	28.2
GSM850 GPRS 3 Slots	16.2	16.2	16.2	16.2	16.2	26.5	26.5	26.5	26.5	26.5
GSM850 GPRS 4 Slots	15.9	15.9	15.9	15.9	15.9	24.5	24.5	24.5	24.5	24.5

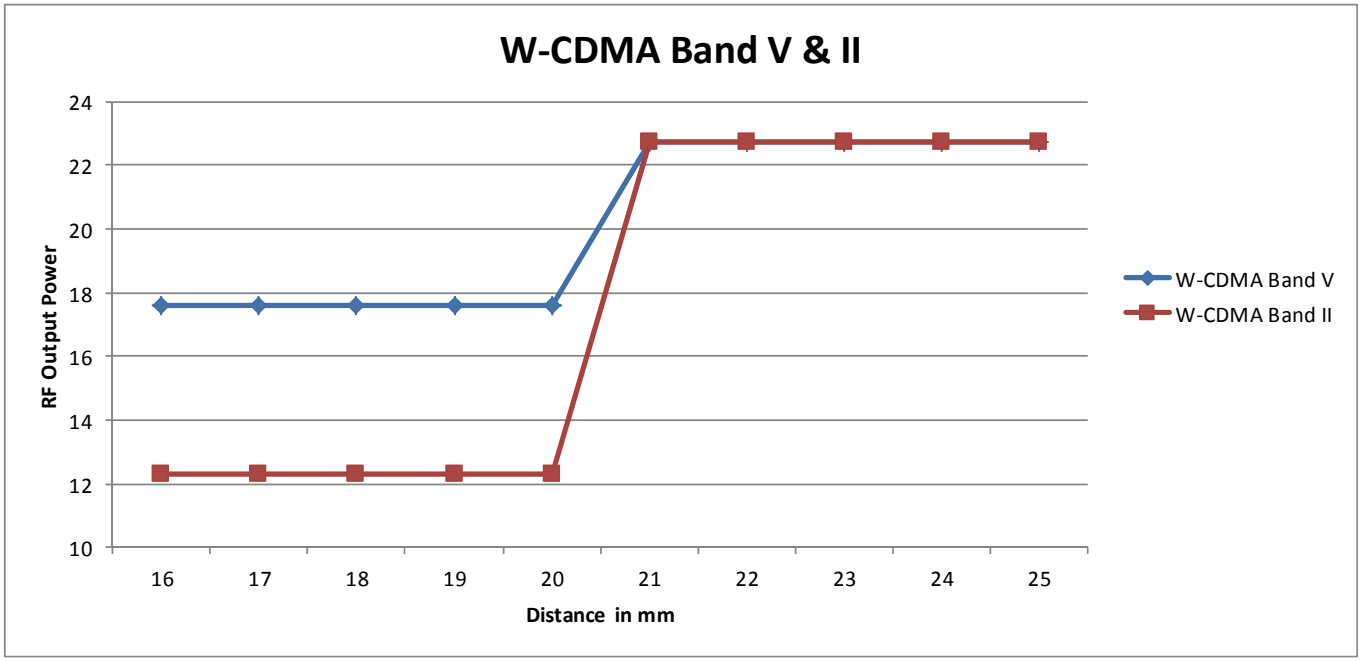


This report shall not be reproduced without the written approval of UL Verification Services Inc.

WCDMA Bands V & II

Rear, DUT Moving Toward (Trigger) and Away (Release) from the Phantom

Distance to DUT vs. Output Power in dBm										
Distance (mm)	16	17	18	19	20	21	22	23	24	25
W-CDMA Band V	17.6	17.6	17.6	17.6	17.6	22.7	22.7	22.7	22.7	22.7
W-CDMA Band II	12.3	12.3	12.3	12.3	12.3	22.7	22.7	22.7	22.7	22.7

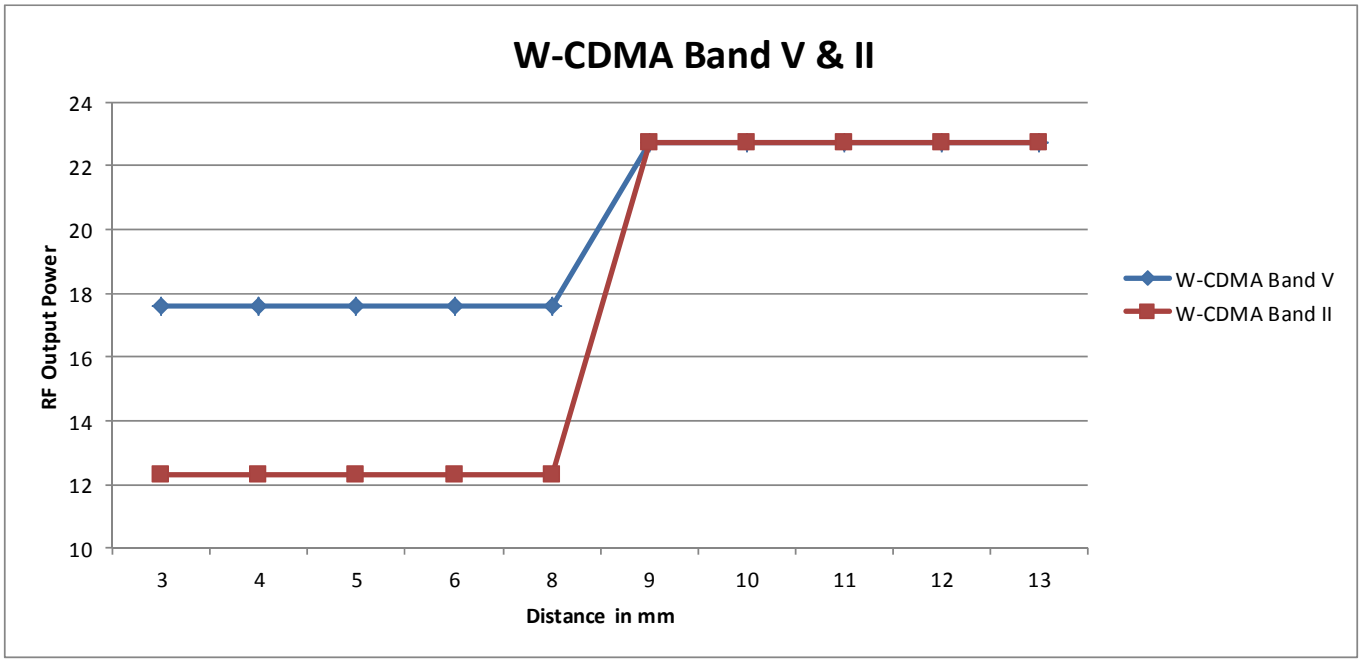


This report shall not be reproduced without the written approval of UL Verification Services Inc.

WCDMA Bands V & II

Edge 2, DUT Moving Toward (Trigger) and Away (Release) from the Phantom

Distance to DUT vs. Output Power in dBm										
Distance (mm)	3	4	5	6	8	9	10	11	12	13
W-CDMA Band V	17.6	17.6	17.6	17.6	17.6	22.7	22.7	22.7	22.7	22.7
W-CDMA Band II	12.3	12.3	12.3	12.3	12.3	22.7	22.7	22.7	22.7	22.7

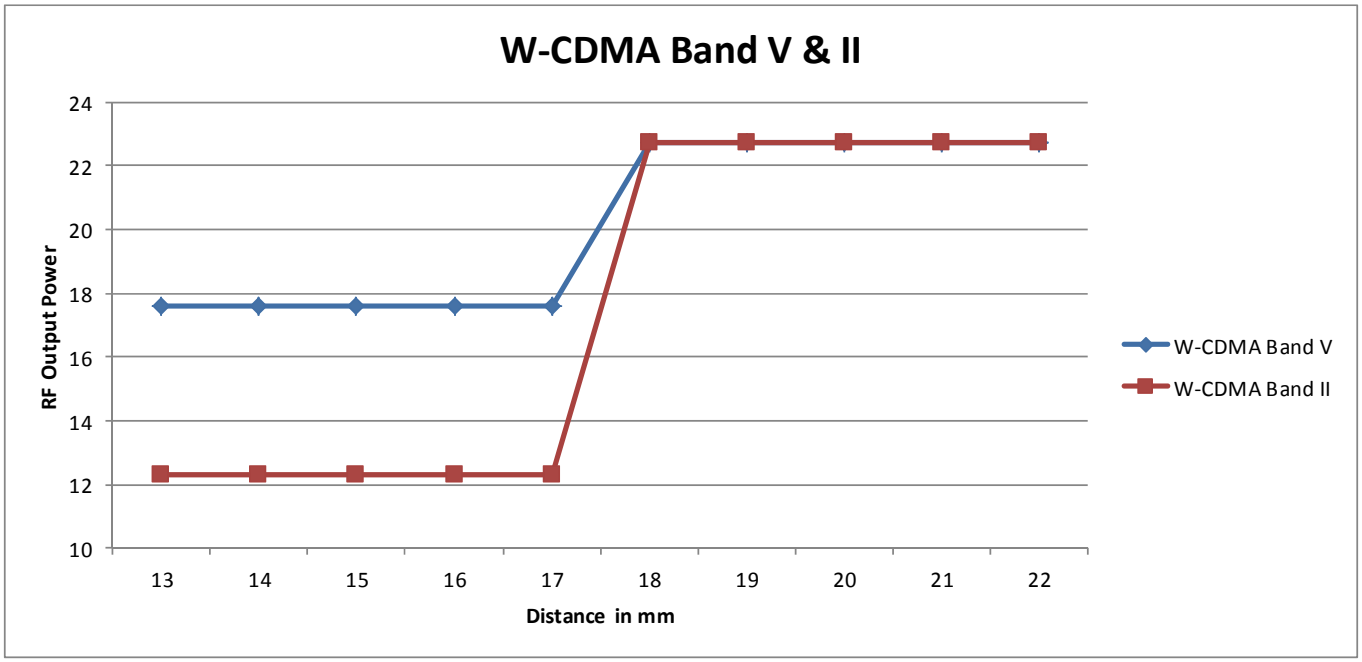


This report shall not be reproduced without the written approval of UL Verification Services Inc.

WCDMA Bands V & II

Edge 3, DUT Moving Toward (Trigger) and Away (Release) from the Phantom

Distance to DUT vs. Output Power in dBm										
Distance (mm)	13	14	15	16	17	18	19	20	21	22
W-CDMA Band V	17.6	17.6	17.6	17.6	17.6	22.7	22.7	22.7	22.7	22.7
W-CDMA Band II	12.3	12.3	12.3	12.3	12.3	22.7	22.7	22.7	22.7	22.7

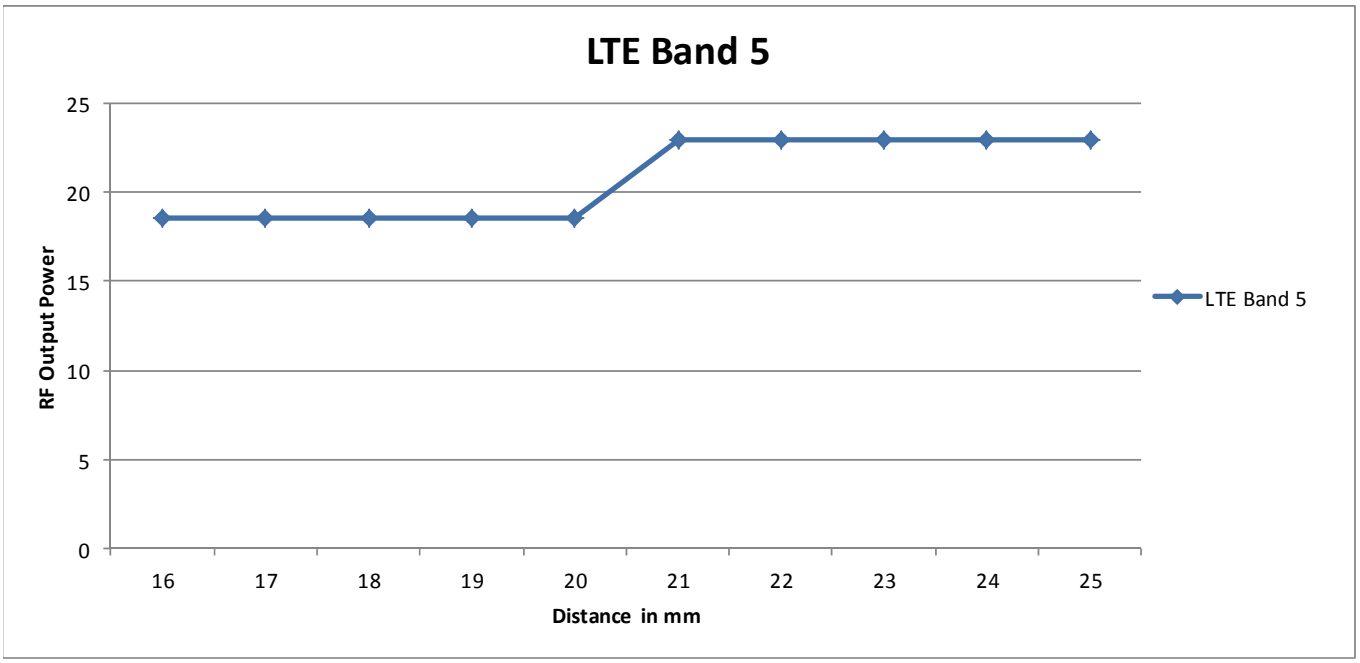


This report shall not be reproduced without the written approval of UL Verification Services Inc.

LTE Band 5

Rear, DUT Moving Toward (Trigger) and Away (Release) from the Phantom

Distance to DUT vs. Output Power in dBm										
Distance (mm)	16	17	18	19	20	21	22	23	24	25
LTE Band 5	18.5	18.5	18.5	18.5	18.5	22.9	22.9	22.9	22.9	22.9

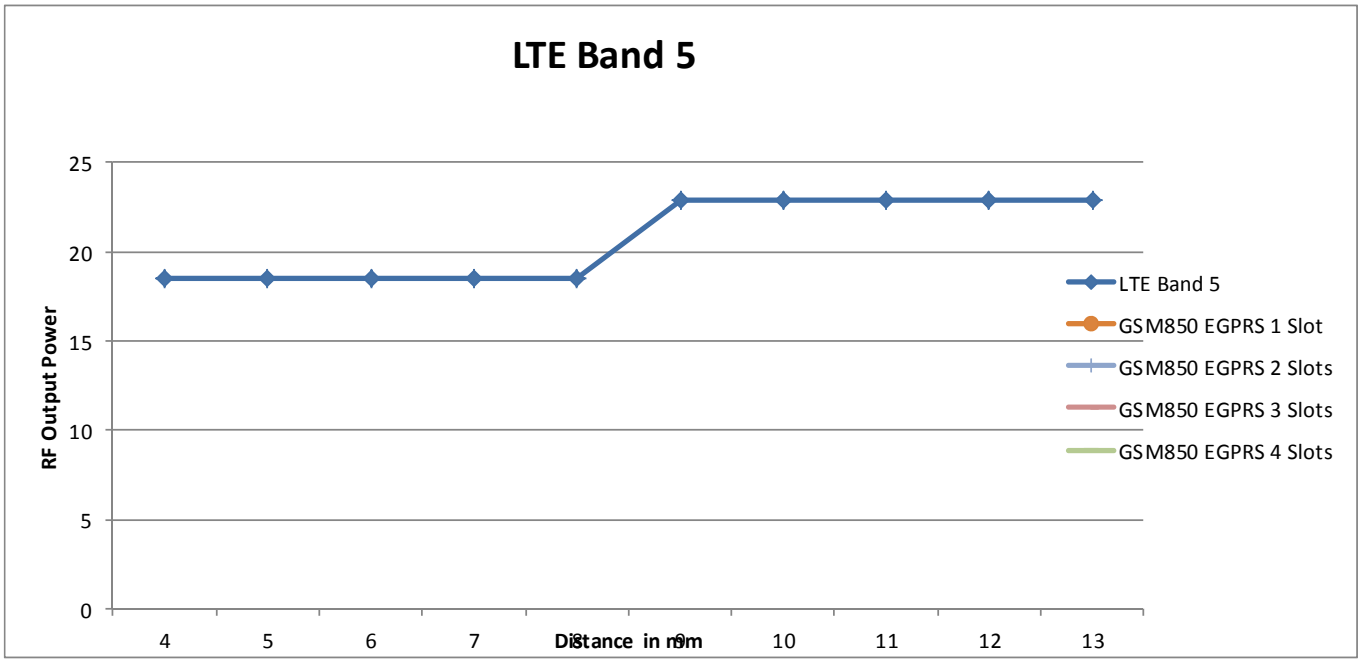


This report shall not be reproduced without the written approval of UL Verification Services Inc.

LTE Band 5

Edge 2, DUT Moving Toward (Trigger) and Away (Release) from the Phantom

Distance to DUT vs. Output Power in dBm										
Distance (mm)	4	5	6	7	8	9	10	11	12	13
LTE Band 5	18.5	18.5	18.5	18.5	18.5	22.9	22.9	22.9	22.9	22.9

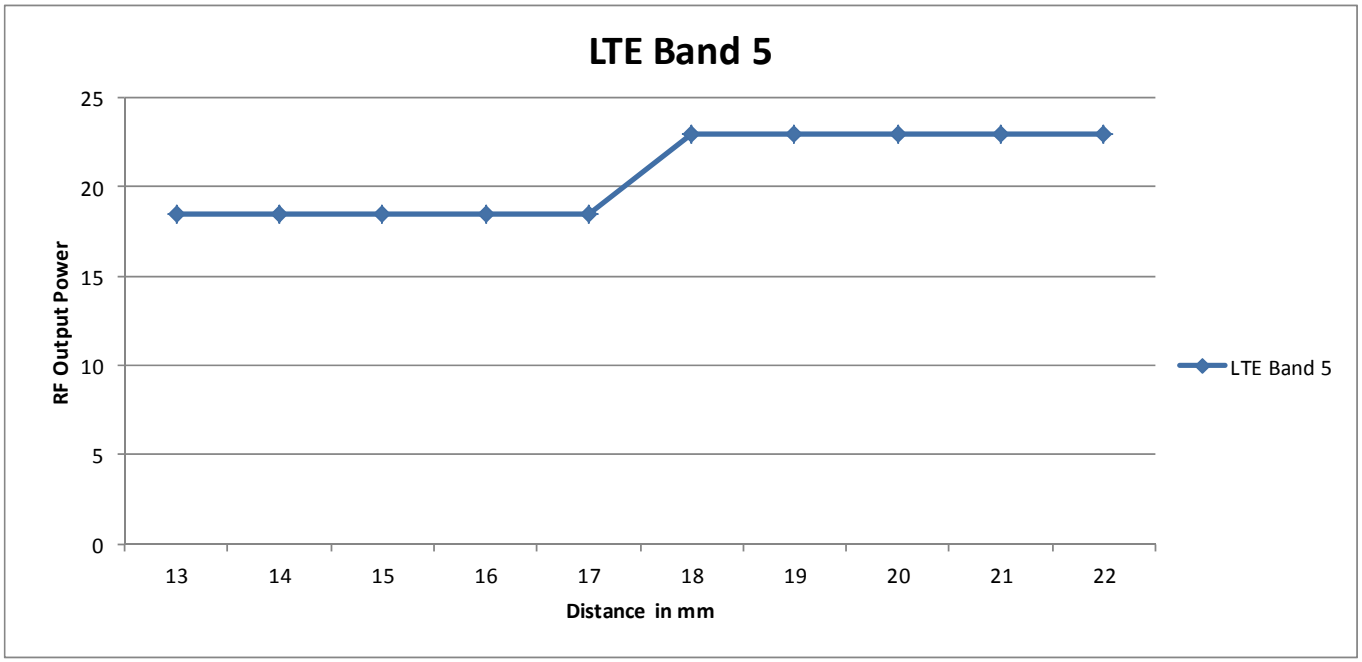


This report shall not be reproduced without the written approval of UL Verification Services Inc.

LTE Band 5

Edge 3, DUT Moving Toward (Trigger) and Away (Release) from the Phantom

Distance to DUT vs. Output Power in dBm										
Distance (mm)	13	14	15	16	17	18	19	20	21	22
LTE Band 5	18.5	18.5	18.5	18.5	18.5	22.9	22.9	22.9	22.9	22.9

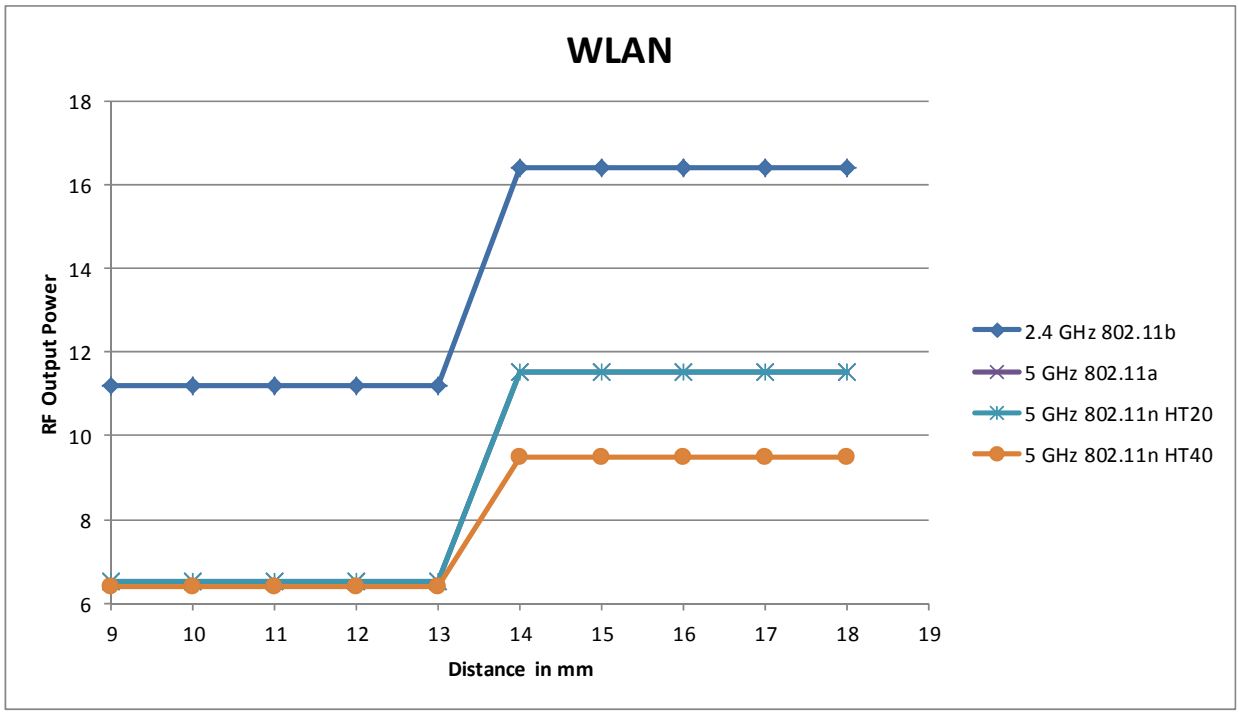


This report shall not be reproduced without the written approval of UL Verification Services Inc.

Wi-Fi 2.4GHz and 5GHz

Rear, DUT Moving Toward (Trigger) and Away (Release) from the Phantom

Distance to DUT vs. Output Power in dBm										
Distance	9	10	11	12	13	14	15	16	17	18
2.4 GHz 802.11b	11.20	11.20	11.20	11.20	11.20	16.40	16.40	16.40	16.40	16.40
5 GHz 802.11a	6.50	6.50	6.50	6.50	6.50	11.50	11.50	11.50	11.50	11.50
5 GHz 802.11n HT20	6.50	6.50	6.50	6.50	6.50	11.50	11.50	11.50	11.50	11.50
5 GHz 802.11n HT40	6.40	6.40	6.40	6.40	6.40	9.50	9.50	9.50	9.50	9.50

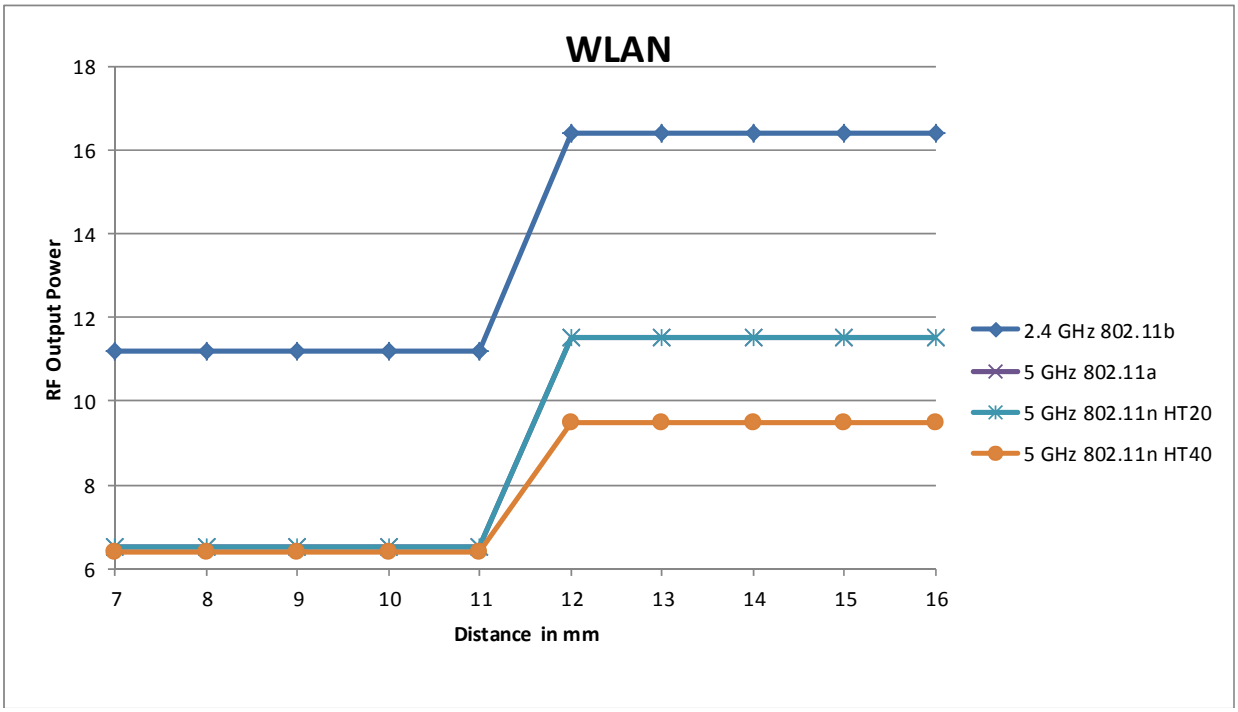


This report shall not be reproduced without the written approval of UL Verification Services Inc.

Wi-Fi 2.4GHz and 5GHz

Edge 1, DUT Moving Toward (Trigger) and Away (Release) from the Phantom

Distance to DUT vs. Output Power in dBm										
Distance	7	8	9	10	11	12	13	14	15	16
2.4 GHz 802.11b	11.20	11.20	11.20	11.20	11.20	16.40	16.40	16.40	16.40	16.40
5 GHz 802.11a	6.50	6.50	6.50	6.50	6.50	11.50	11.50	11.50	11.50	11.50
5 GHz 802.11n HT20	6.50	6.50	6.50	6.50	6.50	11.50	11.50	11.50	11.50	11.50
5 GHz 802.11n HT40	6.40	6.40	6.40	6.40	6.40	9.50	9.50	9.50	9.50	9.50



This report shall not be reproduced without the written approval of UL Verification Services Inc.

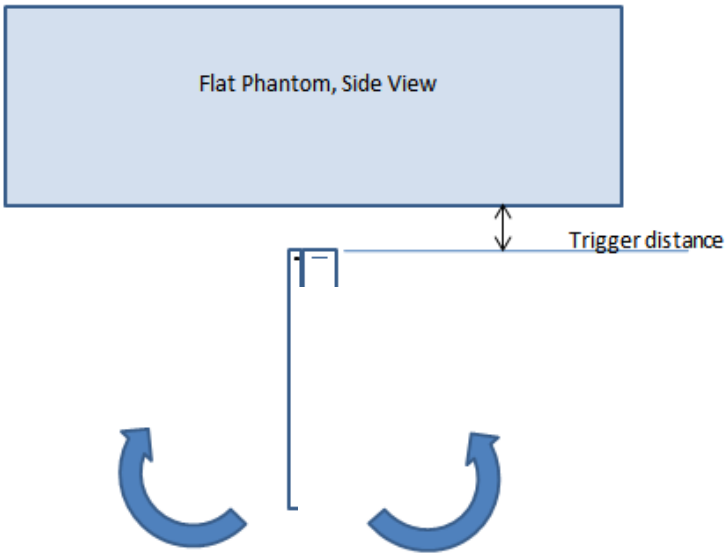
6.6.3. Proximity Sensor Coverage (KDB 616217 §6.3)

As there is no spatial offset between the antenna and the proximity sensor element, proximity sensor coverage did not need to be assessed.

6.6.4. Proximity Sensor Tilt Angle Assessment (KDB 616217 §6.4)

The DUT was positioned directly below the flat phantom at the minimum measured trigger distance with Edge 3 parallel to the base of the flat phantom for each band.

The EUT was rotated about Edge 3 for angles up to +/- 45°. If the output power increased during the rotation the DUT was moved 1mm toward the phantom and the rotation repeated. This procedure was repeated until the power remained reduced for all angles up to +/- 45°.



Proximity sensor tilt angle assessment (Edge 3) KDB 616217 §6.4

Summary of Tablet Tilt Angle Influence to Proximity Sensor Triggering for Edge 3

Band (MHz)	Minimum trigger distance measured according to KDB 616217 §6.2	Minimum distance at which power reduction was maintained over +/-45°	Power reduction status										
			-45°	-40°	-30°	-20°	-10°	0°	10°	20°	30°	40°	45°
850	5 mm	5 mm	On	On	On	On	On	On	On	On	On	On	On
1900	5 mm	5 mm	On	On	On	On	On	On	On	On	On	On	On
2400	5 mm	5 mm	On	On	On	On	On	On	On	On	On	On	On
5000	5 mm	5 mm	On	On	On	On	On	On	On	On	On	On	On

This report shall not be reproduced without the written approval of UL Verification Services Inc.

6.6.1. Resulting test positions for SAR measurements

Wireless technologies	Position	§6.2 Triggering Distance	§6.3 Coverage	§6.4 Tilt Angle
WWAN	Rear	20 mm	N/A	N/A
	Edge 2	8 mm	N/A	8 mm
	Edge 3	15 mm	N/A	15 mm
WLAN	Rear	13 mm	N/A	N/A
	Edge 1	11 mm	N/A	11 mm
	Edge 2	0 mm	N/A	0 mm

This report shall not be reproduced without the written approval of UL Verification Services Inc.

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.

7.1. Standalone SAR Test Exclusion Considerations

Since the *Dedicated Host Approach* is applied, the standalone SAR test exclusion procedure in KDB 447498 § 4.3.1 is applied in conjunction with KDB 616217 § 4.3 to determine the minimum test separation distance:

- When the separation distance from the antenna to an adjacent edge is ≤ 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.
- When the separation distance from the antenna to an adjacent edge is > 5 mm, the actual antenna-to-edge separation distance is applied to determine SAR test exclusion.

SAR Test Exclusion Calculations for WWAN

Antennas < 50mm to adjacent edges

Antenna	Tx Interface	Frequency (MHz)	Output Power		Separation Distances (mm)					Calculated Threshold Value				
			dBm	mW	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Rear	Edge 1	Edge 2	Edge 3	Edge 4
Full Power														
Cellular	GPRS 3 Slots	824.2	30.00	375	24	195	12	19	91	14.2 -MEASURE-	>50 mm	28.4 -MEASURE-	17.9 -MEASURE-	>50 mm
Cellular	GPRS 3 Slots	1909.8	24.50	106	24	195	12	19	91	6.1 -MEASURE-	>50 mm	12.2 -MEASURE-	7.7 -MEASURE-	>50 mm
Cellular	W-CDMA V	836.6	23.00	200	24	195	12	19	91	7.6 -MEASURE-	>50 mm	15.2 -MEASURE-	9.6 -MEASURE-	>50 mm
Cellular	W-CDMA II	1907.6	23.00	200	24	195	12	19	91	11.5 -MEASURE-	>50 mm	23 -MEASURE-	14.5 -MEASURE-	>50 mm
Cellular	LTE Band 5	844	23.00	200	24	195	12	19	91	7.7 -MEASURE-	>50 mm	15.3 -MEASURE-	9.7 -MEASURE-	>50 mm
Power Back Off														
Cellular	GPRS 3 Slots	848.8	24.50	106	5	195	5	5	91	19.5 -MEASURE-	>50 mm	19.5 -MEASURE-	19.5 -MEASURE-	>50 mm
Cellular	EGPRS 4 Slots	848.8	23.50	112	5	195	5	5	91	20.6 -MEASURE-	>50 mm	20.6 -MEASURE-	20.6 -MEASURE-	>50 mm
Cellular	GPRS 4 Slots	1909.8	16.00	20	5	195	5	5	91	5.5 -MEASURE-	>50 mm	5.5 -MEASURE-	5.5 -MEASURE-	>50 mm
Cellular	W-CDMA V	846.6	18.00	63	5	195	5	5	91	11.6 -MEASURE-	>50 mm	11.6 -MEASURE-	11.6 -MEASURE-	>50 mm
Cellular	W-CDMA II	1907.6	12.50	18	5	195	5	5	91	5 -MEASURE-	>50 mm	5 -MEASURE-	5 -MEASURE-	>50 mm
Cellular	LTE Band 5	844	18.50	71	5	195	5	5	91	13 -MEASURE-	>50 mm	13 -MEASURE-	13 -MEASURE-	>50 mm

Note(s):

1. According to KDB 447498, if the calculated threshold value is >3 then SAR testing is required.

This report shall not be reproduced without the written approval of UL Verification Services Inc.

Antennas > 50mm to adjacent edges

Antenna	Tx Interface	Frequency (MHz)	Output Power		Separation Distances (mm)					Calculated Threshold Value				
			dBm	mW	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Rear	Edge 1	Edge 2	Edge 3	Edge 4
Full Power														
Cellular	GPRS 2 Slots	824.2	30.00	250	24	195	12	19	91	< 50 mm	962 mW -EXEMPT-	< 50 mm	< 50 mm	390.5 mW -EXEMPT-
Cellular	GPRS 2 Slots	1909.8	24.50	70	24	195	12	19	91	< 50 mm	1558.5 mW -EXEMPT-	< 50 mm	< 50 mm	518.5 mW -EXEMPT-
Cellular	W-CDMA V	836.6	23.00	200	24	195	12	19	91	< 50 mm	972.7 mW -EXEMPT-	< 50 mm	< 50 mm	392.7 mW -EXEMPT-
Cellular	W-CDMA II	1907.6	23.00	200	24	195	12	19	91	< 50 mm	1558.6 mW -EXEMPT-	< 50 mm	< 50 mm	518.6 mW -EXEMPT-
Cellular	LTE Band 5	844	23.00	200	24	195	12	19	91	< 50 mm	979.1 mW -EXEMPT-	< 50 mm	< 50 mm	394 mW -EXEMPT-
Power Back Off														
Cellular	GPRS 3 Slots	848.8	24.50	106	5	195	5	5	91	< 50 mm	983.3 mW -EXEMPT-	< 50 mm	< 50 mm	394.8 mW -EXEMPT-
Cellular	EGPRS 4 Slots	848.8	23.50	112	5	195	5	5	91	< 50 mm	983.3 mW -EXEMPT-	< 50 mm	< 50 mm	394.8 mW -EXEMPT-
Cellular	GPRS 4 Slots	1909.8	16.00	20	5	195	5	5	91	< 50 mm	1558.5 mW -EXEMPT-	< 50 mm	< 50 mm	518.5 mW -EXEMPT-
Cellular	W-CDMA V	846.6	18.00	63	5	195	5	5	91	< 50 mm	981.4 mW -EXEMPT-	< 50 mm	< 50 mm	394.4 mW -EXEMPT-
Cellular	W-CDMA II	1907.6	12.50	18	5	195	5	5	91	< 50 mm	1558.6 mW -EXEMPT-	< 50 mm	< 50 mm	518.6 mW -EXEMPT-
Cellular	LTE Band 5	844	18.50	71	5	195	5	5	91	< 50 mm	979.1 mW -EXEMPT-	< 50 mm	< 50 mm	394 mW -EXEMPT-

Note(s):

1. According to KDB 447498, if the calculated Power threshold is less than the output power then SAR testing is required.

SAR Test Exclusion Calculations for WLAN

Antennas < 50mm to adjacent edges

Tx Interface	Frequency (MHz)	Output Power		Separation Distances (mm)						Calculated Threshold Value					
		dBm	mW	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Front	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Front
Full Power															
Wi-Fi 2.4 GHz	2462	16.50	45	13	23	14.5	190	98		5.4 -MEASURE-	3.1 -MEASURE-	4.7 -MEASURE-	> 50 mm	> 50 mm	
Wi-Fi 5.2 GHz	5180	11.50	14	13	23	14.5	190	98		2.5 -EXEMPT-	1.4 -EXEMPT-	2.1 -EXEMPT-	> 50 mm	> 50 mm	
Wi-Fi 5.3 GHz	5260	11.50	14	13	23	14.5	190	98		2.5 -EXEMPT-	1.4 -EXEMPT-	2.1 -EXEMPT-	> 50 mm	> 50 mm	
Wi-Fi 5.5 GHz	5580	11.50	14	13	23	14.5	190	98		2.5 -EXEMPT-	1.4 -EXEMPT-	2.2 -EXEMPT-	> 50 mm	> 50 mm	
Wi-Fi 5.8 GHz	5825	11.50	14	13	23	14.5	190	98		2.6 -EXEMPT-	1.5 -EXEMPT-	2.3 -EXEMPT-	> 50 mm	> 50 mm	
Bluetooth	2480	10.50	11	0	12	14.5	190	98		3.5 -MEASURE-	1.4 -EXEMPT-	1.2 -EXEMPT-	> 50 mm	> 50 mm	
Power Back Off															
Wi-Fi 2.4 GHz	2462	11.50	14	5	12					4.4 -MEASURE-	1.8 -EXEMPT-				
Wi-Fi 5.2 GHz	5180	6.50	4	5	12					1.8 -EXEMPT-	0.8 -EXEMPT-				
Wi-Fi 5.3 GHz	5260	6.50	4	5	12					1.8 -EXEMPT-	0.8 -EXEMPT-				
Wi-Fi 5.5 GHz	5580	6.50	4	5	12					1.9 -EXEMPT-	0.8 -EXEMPT-				
Wi-Fi 5.8 GHz	5825	6.50	4	5	12					1.9 -EXEMPT-	0.8 -EXEMPT-				

Note(s):

1. According to KDB 447498, if the calculated threshold value is >3 then SAR testing is required.

This report shall not be reproduced without the written approval of UL Verification Services Inc.

Antennas > 50mm to adjacent edges

Tx Interface	Frequency (MHz)	Output Power		Separation Distances (mm)						Calculated Threshold Value					
		dBm	mW	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Front	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Front
Full Power															
Wi-Fi 2.4 GHz	2462	16.50	45	13	23	14.5	190	98		*< 50 mm*	*< 50 mm*	*< 50 mm*	1495.6 mW -EXEMPT-	575.6 mW -EXEMPT-	
Wi-Fi 5.2 GHz	5180	11.50	14	13	23	14.5	190	98		*< 50 mm*	*< 50 mm*	*< 50 mm*	1465.9 mW -EXEMPT-	545.9 mW -EXEMPT-	
Wi-Fi 5.3 GHz	5260	11.50	14	13	23	14.5	190	98		*< 50 mm*	*< 50 mm*	*< 50 mm*	1465.4 mW -EXEMPT-	545.4 mW -EXEMPT-	
Wi-Fi 5.5 GHz	5580	11.50	14	13	23	14.5	190	98		*< 50 mm*	*< 50 mm*	*< 50 mm*	1463.5 mW -EXEMPT-	543.5 mW -EXEMPT-	
Wi-Fi 5.8 GHz	5825	11.50	14	13	23	14.5	190	98		*< 50 mm*	*< 50 mm*	*< 50 mm*	1462.2 mW -EXEMPT-	542.2 mW -EXEMPT-	
Bluetooth	2480	10.50	11	13	23	14.5	190	98		*< 50 mm*	*< 50 mm*	*< 50 mm*	1495.3 mW -EXEMPT-	575.3 mW -EXEMPT-	
Power Back Off															
Wi-Fi 2.4 GHz	2462	11.50	14	5	12					*< 50 mm*	*< 50 mm*				
Wi-Fi 5.2 GHz	5180	6.50	4	5	12					*< 50 mm*	*< 50 mm*				
Wi-Fi 5.3 GHz	5260	6.50	4	5	12					*< 50 mm*	*< 50 mm*				
Wi-Fi 5.5 GHz	5580	6.50	4	5	12					*< 50 mm*	*< 50 mm*				
Wi-Fi 5.8 GHz	5825	6.50	4	5	12					*< 50 mm*	*< 50 mm*				

Note(s):

1. According to KDB 447498, if the calculated Power threshold is less than the output power then SAR testing is required.

This report shall not be reproduced without the written approval of UL Verification Services Inc.

7.2. Required Test Configurations

The table below identifies the standalone test configurations required for this device according to the findings in Section 7.1:

Test Configurations	Rear	Edge 1	Edge 2	Edge 3	Edge 4
		(Top Edge)	(Right Edge)	(Bottom Edge)	(Left Edge)
GSM850 Full Power	Yes	No	Yes	Yes	No
GSM850 w / Power Reduction	Yes	No	Yes	Yes	No
GSM1900 Full Power	Yes	No	Yes	Yes	No
GSM1900 w / Power Reduction	Yes	No	Yes	Yes	No
W-CDMA Band 2 Full Power	Yes	No	Yes	Yes	No
W-CDMA Band 2 w / Power Reduction	Yes	No	Yes	Yes	No
W-CDMA Band 5 Full Power	Yes	No	Yes	Yes	No
W-CDMA Band 5 w / Power Reduction	Yes	No	Yes	Yes	No
LTE Band 5 Full Power	Yes	No	Yes	Yes	No
LTE Band 5 w / Power Reduction	Yes	No	Yes	Yes	No
Wi-Fi 2.4 GHz Full Power	Yes	Yes	Yes	No	No
Wi-Fi 2.4 GHz Reduced Power	Yes	No	No	No	No
Wi-Fi 5 GHz Full Power	No	No	No	No	No
Wi-Fi 5 GHz Reduced Power	No	No	No	No	No
Bluetooth	Yes	No	No	No	No

Note(s):

1. Yes = Testing is required.
2. No = Testing is not required.

This report shall not be reproduced without the written approval of UL Verification Services Inc.

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

This report shall not be reproduced without the written approval of UL Verification Services Inc.

Dielectric Property Measurements Results:

SAR Lab B

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
2/20/2015	Body 2450	e'	51.2000	Relative Permittivity (ε_r):	51.20	52.70	-2.85	5
		e"	14.3200	Conductivity (σ):	1.95	1.95	0.04	5
	Body 2410	e'	51.2800	Relative Permittivity (ε_r):	51.28	52.76	-2.80	5
		e"	14.2500	Conductivity (σ):	1.91	1.91	0.11	5
	Body 2475	e'	51.1700	Relative Permittivity (ε_r):	51.17	52.67	-2.85	5
		e"	14.3100	Conductivity (σ):	1.97	1.99	-0.80	5

This report shall not be reproduced without the written approval of UL Verification Services Inc.

SAR Lab F

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
2/16/2015	Body 835	e'	53.3100	Relative Permittivity (ε_r):	53.31	55.20	-3.42	5
		e"	21.5000	Conductivity (σ):	1.00	0.97	2.91	5
	Body 820	e'	53.5100	Relative Permittivity (ε_r):	53.51	55.28	-3.20	5
		e"	21.6200	Conductivity (σ):	0.99	0.97	1.79	5
	Body 850	e'	53.1200	Relative Permittivity (ε_r):	53.12	55.16	-3.69	5
		e"	21.4000	Conductivity (σ):	1.01	0.99	2.46	5
2/16/2015	Head 835	e'	41.0400	Relative Permittivity (ε_r):	41.04	41.50	-1.11	5
		e"	19.3000	Conductivity (σ):	0.90	0.90	-0.44	5
	Head 820	e'	41.2400	Relative Permittivity (ε_r):	41.24	41.60	-0.87	5
		e"	19.1200	Conductivity (σ):	0.87	0.90	-2.97	5
	Head 850	e'	40.7800	Relative Permittivity (ε_r):	40.78	41.50	-1.73	5
		e"	18.9200	Conductivity (σ):	0.89	0.92	-2.27	5
2/17/2015	Head 835	e'	41.0500	Relative Permittivity (ε_r):	41.05	41.50	-1.08	5
		e"	19.2200	Conductivity (σ):	0.89	0.90	-0.85	5
	Head 820	e'	41.2000	Relative Permittivity (ε_r):	41.20	41.60	-0.97	5
		e"	19.3000	Conductivity (σ):	0.88	0.90	-2.06	5
	Head 850	e'	40.8100	Relative Permittivity (ε_r):	40.81	41.50	-1.66	5
		e"	19.0600	Conductivity (σ):	0.90	0.92	-1.55	5
2/18/2015	Head 1900	e'	38.9100	Relative Permittivity (ε_r):	38.91	40.00	-2.73	5
		e"	13.3700	Conductivity (σ):	1.41	1.40	0.89	5
	Head 1850	e'	39.1300	Relative Permittivity (ε_r):	39.13	40.00	-2.17	5
		e"	13.3700	Conductivity (σ):	1.38	1.40	-1.76	5
	Head 1910	e'	38.8700	Relative Permittivity (ε_r):	38.87	40.00	-2.83	5
		e"	13.3600	Conductivity (σ):	1.42	1.40	1.35	5
2/18/2015	Head 5180	e'	35.8000	Relative Permittivity (ε_r):	35.80	36.01	-0.59	5
		e"	15.5700	Conductivity (σ):	4.48	4.63	-3.15	5
	Head 5200	e'	35.7600	Relative Permittivity (ε_r):	35.76	35.99	-0.64	5
		e"	15.5900	Conductivity (σ):	4.51	4.65	-3.08	5
	Head 5600	e'	35.4500	Relative Permittivity (ε_r):	35.45	35.53	-0.24	5
		e"	15.7300	Conductivity (σ):	4.90	5.06	-3.21	5
	Head 5800	e'	35.3200	Relative Permittivity (ε_r):	35.32	35.30	0.06	5
		e"	15.5500	Conductivity (σ):	5.01	5.27	-4.84	5
	Head 5825	e'	35.2900	Relative Permittivity (ε_r):	35.29	35.30	-0.03	5
		e"	15.5500	Conductivity (σ):	5.04	5.27	-4.43	5
2/18/2015	Body 5180	e'	49.0500	Relative Permittivity (ε_r):	49.05	49.05	0.01	5
		e"	17.6200	Conductivity (σ):	5.07	5.27	-3.73	5
	Body 5200	e'	49.0700	Relative Permittivity (ε_r):	49.07	49.02	0.10	5
		e"	17.6200	Conductivity (σ):	5.09	5.29	-3.78	5
	Body 5600	e'	48.4600	Relative Permittivity (ε_r):	48.46	48.48	-0.04	5
		e"	18.0000	Conductivity (σ):	5.60	5.76	-2.71	5
	Body 5800	e'	48.3100	Relative Permittivity (ε_r):	48.31	48.20	0.23	5
		e"	18.1100	Conductivity (σ):	5.84	6.00	-2.66	5
	Body 5825	e'	48.2700	Relative Permittivity (ε_r):	48.27	48.20	0.15	5
		e"	18.2000	Conductivity (σ):	5.89	6.00	-1.75	5
2/25/2015	Body 5180	e'	47.6800	Relative Permittivity (ε_r):	47.68	49.05	-2.79	5
		e"	18.3400	Conductivity (σ):	5.28	5.27	0.21	5
	Body 5200	e'	47.6700	Relative Permittivity (ε_r):	47.67	49.02	-2.75	5
		e"	18.3600	Conductivity (σ):	5.31	5.29	0.26	5
	Body 5600	e'	47.0300	Relative Permittivity (ε_r):	47.03	48.48	-2.99	5
		e"	18.6800	Conductivity (σ):	5.82	5.76	0.96	5
	Body 5800	e'	46.7300	Relative Permittivity (ε_r):	46.73	48.20	-3.05	5
		e"	18.8400	Conductivity (σ):	6.08	6.00	1.26	5
	Body 5825	e'	46.7200	Relative Permittivity (ε_r):	46.72	48.20	-3.07	5
		e"	18.8600	Conductivity (σ):	6.11	6.00	1.81	5

This report shall not be reproduced without the written approval of UL Verification Services Inc.

SAR Lab G

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
2/9/2015	Body 835	e'	52.6600	Relative Permittivity (ε_r):	52.66	55.20	-4.60	5
		e"	21.9000	Conductivity (σ):	1.02	0.97	4.82	5
	Body 820	e'	52.8100	Relative Permittivity (ε_r):	52.81	55.28	-4.46	5
		e"	22.0300	Conductivity (σ):	1.00	0.97	3.72	5
	Body 850	e'	52.5700	Relative Permittivity (ε_r):	52.57	55.16	-4.69	5
		e"	21.8900	Conductivity (σ):	1.03	0.99	4.81	5
2/9/2015	Head 835	e'	39.6200	Relative Permittivity (ε_r):	39.62	41.50	-4.53	5
		e"	19.1800	Conductivity (σ):	0.89	0.90	-1.06	5
	Head 820	e'	39.8200	Relative Permittivity (ε_r):	39.82	41.60	-4.28	5
		e"	19.2700	Conductivity (σ):	0.88	0.90	-2.21	5
	Head 850	e'	39.5000	Relative Permittivity (ε_r):	39.50	41.50	-4.82	5
		e"	19.2000	Conductivity (σ):	0.91	0.92	-0.83	5
2/11/2015	Body 1900	e'	52.1400	Relative Permittivity (ε_r):	52.14	53.30	-2.18	5
		e"	14.8400	Conductivity (σ):	1.57	1.52	3.14	5
	Body 1850	e'	52.3700	Relative Permittivity (ε_r):	52.37	53.30	-1.74	5
		e"	14.7300	Conductivity (σ):	1.52	1.52	-0.31	5
	Body 1910	e'	52.0800	Relative Permittivity (ε_r):	52.08	53.30	-2.29	5
		e"	14.8500	Conductivity (σ):	1.58	1.52	3.76	5
2/13/2015	Head 1900	e'	39.1000	Relative Permittivity (ε_r):	39.10	40.00	-2.25	5
		e"	13.3900	Conductivity (σ):	1.41	1.40	1.04	5
	Head 1850	e'	39.4000	Relative Permittivity (ε_r):	39.40	40.00	-1.50	5
		e"	13.2000	Conductivity (σ):	1.36	1.40	-3.01	5
	Head 1910	e'	39.1100	Relative Permittivity (ε_r):	39.11	40.00	-2.23	5
		e"	13.4400	Conductivity (σ):	1.43	1.40	1.95	5
2/16/2015	Head 2450	e'	40.5100	Relative Permittivity (ε_r):	40.51	39.20	3.34	5
		e"	13.7500	Conductivity (σ):	1.87	1.80	4.06	5
	Head 2410	e'	40.6600	Relative Permittivity (ε_r):	40.66	39.28	3.52	5
		e"	13.6200	Conductivity (σ):	1.83	1.76	3.67	5
	Head 2475	e'	40.4100	Relative Permittivity (ε_r):	40.41	39.17	3.17	5
		e"	13.7700	Conductivity (σ):	1.89	1.83	3.72	5
2/16/2015	Body 2450	e'	51.6700	Relative Permittivity (ε_r):	51.67	52.70	-1.95	5
		e"	14.8300	Conductivity (σ):	2.02	1.95	3.60	5
	Body 2410	e'	51.8100	Relative Permittivity (ε_r):	51.81	52.76	-1.80	5
		e"	14.6800	Conductivity (σ):	1.97	1.91	3.13	5
	Body 2475	e'	51.5500	Relative Permittivity (ε_r):	51.55	52.67	-2.12	5
		e"	14.9100	Conductivity (σ):	2.05	1.99	3.36	5

This report shall not be reproduced without the written approval of UL Verification Services Inc.

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.

This report shall not be reproduced without the written approval of UL Verification Services Inc.

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
D835V2	4d117	9/17/2013	835	1g	9.23	9.61
				10g	5.98	6.31
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
D5GHzV2	1168	12/12/2013	5200	1g	79.3	76.0
				10g	22.5	21.1
			5600	1g	81.7	82.0
				10g	23.2	22.7
			5800	1g	78.0	76.2
				10g	22.1	21.0

This report shall not be reproduced without the written approval of UL Verification Services Inc.

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			
2/20/2015	D2450V2	706	Body	1g	4.98	49.8	50.2	-0.80	1, 2
				10g	2.31	23.1	23.4	-1.28	

SAR Lab F

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			
2/16/2015	D835V2	4d117	Head	1g	0.969	9.7	9.23	4.98	
				10g	0.634	6.3	5.98	6.02	
2/16/2015	D835V2	4d117	Body	1g	1.01	10.1	9.61	5.10	3, 4
				10g	0.665	6.7	6.31	5.39	
2/17/2015	D835V2	4d117	Head	1g	0.887	8.9	9.23	-3.90	
				10g	0.545	5.5	5.98	-8.86	
2/18/2015	D1900V2	5d043	Head	1g	3.9	39.0	40.6	-3.94	5, 6
				10g	2.02	20.2	21.1	-4.27	
2/18/2015	D5GHzV2 (5200)	1168	Body	1g	7.14	71.4	76	-6.05	7, 8
				10g	2.06	20.6	21.1	-2.37	
2/18/2015	D5GHzV2 (5600)	1168	Body	1g	7.90	79.0	82.0	-3.66	
				10g	2.23	22.3	22.7	-1.76	
2/18/2015	D5GHzV2 (5800)	1168	Body	1g	7.67	76.7	76.2	0.66	
				10g	2.18	21.8	21	3.81	
2/18/2015	D5GHzV2 (5200)	1168	Head	1g	7.53	75.3	79.3	-5.04	
				10g	2.18	21.8	22.5	-3.11	
2/18/2015	D5GHzV2 (5600)	1168	Head	1g	8.14	81.4	81.7	-0.37	
				10g	2.32	23.2	23.2	0.00	
2/18/2015	D5GHzV2 (5800)	1168	Head	1g	7.36	73.6	78	-5.64	
				10g	2.10	21.0	22.1	-4.98	
2/26/2015	D5GHzV2 (5200)	1168	Body	1g	7.54	75.4	76.0	-0.79	
				10g	2.15	21.5	21.1	1.90	
2/26/2015	D5GHzV2 (5600)	1168	Body	1g	8.41	84.1	82.0	2.56	
				10g	2.36	23.6	22.7	3.96	
2/26/2015	D5GHzV2 (5800)	1168	Body	1g	7.29	72.9	76.2	-4.33	
				10g	2.05	20.5	21.0	-2.38	

This report shall not be reproduced without the written approval of UL Verification Services Inc.

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			
2/9/2015	D835V2	4d117	Head	1g	0.939	9.4	9.23	1.73	
				10g	0.614	6.1	5.98	2.68	
2/9/2015	D835V2	4d117	Body	1g	0.996	10.0	9.61	3.64	9, 10
				10g	0.656	6.6	6.31	3.96	
2/11/2015	D1900V2	5d043	Body	1g	4.06	40.6	40	1.50	11, 12
				10g	2.14	21.4	21.3	0.47	
2/13/2015	D1900V2	5d043	Head	1g	4.09	40.9	40.6	0.74	
				10g	2.11	21.1	21.1	0.00	
2/16/2015	D2450V2	706	Head	1g	5.42	54.2	53	2.26	
				10g	2.47	24.7	24.5	0.82	
2/16/2015	D2450V2	706	Body	1g	4.85	48.5	50.2	-3.39	13, 14
				10g	2.24	22.4	23.4	-4.27	

This report shall not be reproduced without the written approval of UL Verification Services Inc.

9. Conducted Output Power Measurements

9.1. GSM

GSM850 Measured Results

Band	Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Max. Power		with Pwr Back-off	
						Burst Pwr (dBm)	Frame Pwr (dBm)	Burst Pwr (dBm)	Frame Pwr (dBm)
850	GSM (Voice)	CS1	1	128	824.2	32.5	23.5	28.3	19.3
				190	836.6	32.5	23.5	28.5	19.5
				251	848.8	32.5	23.5	28.5	19.5
	GPRS (GMSK)	CS1	1	128	824.2	32.5	23.5	28.3	19.3
				190	836.6	32.5	23.5	28.5	19.5
				251	848.8	32.5	23.5	28.5	19.5
			2	128	824.2	31.1	25.1	25.1	19.1
				190	836.6	31.2	25.2	25.6	19.6
				251	848.8	30.9	24.9	25.4	19.4
			3	128	824.2	29.5	25.2	23.7	19.4
				190	836.6	29.5	25.2	24.1	19.8
				251	848.8	29.5	25.2	23.9	19.6
			4	128	824.2	27.8	24.8	22.2	19.2
				190	836.6	28.2	25.2	22.6	19.6
				251	848.8	28.0	25.0	22.5	19.5
	EGPRS (8PSK)	MCS5	1	128	824.2	27.1	18.1	26.1	17.1
				190	836.6	27.1	18.1	26.3	17.3
				251	848.8	27.0	18.0	26.2	17.2
			2	128	824.2	25.7	19.7	26.1	20.1
				190	836.6	25.7	19.7	26.4	20.4
				251	848.8	25.6	19.6	26.2	20.2
			3	128	824.2	23.8	19.5	24.2	19.9
				190	836.6	23.8	19.5	24.5	20.2
				251	848.8	23.6	19.3	24.4	20.1
			4	128	824.2	22.4	19.4	23.2	20.2
				190	836.6	22.4	19.4	23.5	20.5
				251	848.8	22.4	19.4	23.4	20.4

Notes:

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

- Head & Body-worn Accessory: GMSK Voice Mode
- Hotspot mode: GMSK (GPRS) mode with 3 time slots for Max power and 3 time slots for Reduced power, based on the output power measurements above
- SAR is required for EGPRS (8PSK) mode because its output power is greater than that of GPRS Mode

This report shall not be reproduced without the written approval of UL Verification Services Inc.

GSM1900 Measured Results

Band	Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Max. Power		with Pwr Back-off	
						Burst Pwr (dBm)	Frame Pwr (dBm)	Burst Pwr (dBm)	Frame Pwr (dBm)
1900	GSM (Voice)	CS1	1	512	1850.2	30.0	21.0	21.3	12.3
				661	1880.0	30.0	21.0	21.4	12.4
				810	1909.8	29.9	20.9	21.2	12.2
	GPRS (GMSK)	CS1	1	512	1850.2	30.0	21.0	21.3	12.3
				661	1880.0	30.0	21.0	21.4	12.4
				810	1909.8	29.9	20.9	21.2	12.2
			2	512	1850.2	28.0	22.0	16.4	10.4
				661	1880.0	28.2	22.2	16.6	10.6
				810	1909.8	28.2	22.2	16.4	10.4
			3	512	1850.2	26.3	22.0	16.1	11.8
				661	1880.0	26.5	22.2	16.2	11.9
				810	1909.8	26.3	22.0	15.9	11.6
			4	512	1850.2	24.4	21.4	15.9	12.9
				661	1880.0	24.5	21.5	15.9	12.9
				810	1909.8	24.4	21.4	15.9	12.9
	EGPRS (8PSK)	MCS5	1	512	1850.2	25.9	16.9	20.8	11.8
				661	1880.0	25.9	16.9	20.9	11.9
				810	1909.8	25.8	16.8	20.7	11.7
			2	512	1850.2	24.5	18.5	15.6	9.6
				661	1880.0	24.7	18.7	15.9	9.9
				810	1909.8	24.7	18.7	15.7	9.7
			3	512	1850.2	22.9	18.6	15.7	11.4
				661	1880.0	23.2	18.9	16.0	11.7
				810	1909.8	23.0	18.7	15.7	11.4
			4	512	1850.2	21.4	18.4	14.8	11.8
				661	1880.0	21.4	18.4	15.1	12.1
				810	1909.8	21.3	18.3	14.8	11.8

Notes:

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

- Head & Body-worn Accessory: GMSK Voice Mode
- Hotspot mode: GMSK (GPRS) mode with 3 time slots for Max power and 4 time slots for Reduced power, 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

This report shall not be reproduced without the written approval of UL Verification Services Inc.

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	11/15	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			

This report shall not be reproduced without the written approval of UL Verification Services Inc.

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 Channelization Codes	2xSF2				SF4

This report shall not be reproduced without the written approval of UL Verification Services Inc.

DC-HSDPA Setup Procedures used to establish the test signals

The following tests were completed according to procedures in section 7.3.13 of 3GPP TS34.108 v9.5.0. A summary of these settings are illustrated below:

Downlink Physical Channels are set as per 3GPP TS34.121-1 v9.0.0 E.5.0

Table E.5.0: Levels for HSDPA connection setup

Parameter During Connection setup	Unit	Value
P-CPICH_Ec/Ior	dB	-10
P-CCPCH and SCH_Ec/Ior	dB	-12
PICH _Ec/Ior	dB	-15
HS-PDSCH	dB	off
HS-SCCH_1	dB	off
DPCH_Ec/Ior	dB	-5
OCNS_Ec/Ior	dB	-3.1

Call is set up as per 3GPP TS34.108 v9.5.0 sub clause 7.3.13

The configurations of the fixed reference channels for HSDPA RF tests are described in 3GPP TS 34.121, annex C for FDD and 3GPP TS 34.122.

Table C.8.1.12: Fixed Reference Channel H-Set 12

Parameter	Unit	Value
Nominal Avg. Inf. Bit Rate	kbps	60
Inter-TTI Distance	TTI's	1
Number of HARQ Processes	Processes	6
Information Bit Payload (N_{INF})	Bits	120
Number Code Blocks	Blocks	1
Binary Channel Bits Per TTI	Bits	960
Total Available SML's in UE	SML's	19200
Number of SML's per HARQ Proc.	SML's	3200
Coding Rate		0.15
Number of Physical Channel Codes	Codes	1
Modulation		QPSK
Note 1: The RMC is intended to be used for DC-HSDPA mode and both cells shall transmit with identical parameters as listed in the table.		
Note 2: Maximum number of transmission is limited to 1, i.e., retransmission is not allowed. The redundancy and constellation version 0 shall be used.		

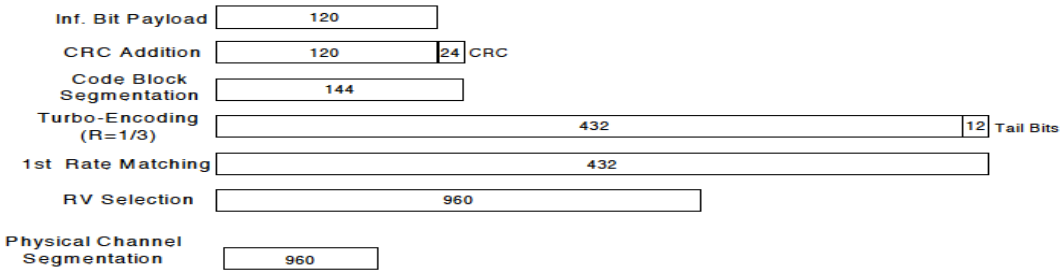


Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)

The following 4 Sub-tests for HSDPA were completed according to Release 8 procedures in section 5.2 of 3GPP TS34.121. A summary of subtest settings are illustrated below:

	Mode	HSDPA	HSDPA	HSDPA	HSDPA
	Subtest	1	2	3	4
WCDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set 1			
	Power Control Algorithm	Algorithm2			
	βc	2/15	11/15	15/15	15/15
	βd	15/15	15/15	8/15	4/15
	βd (SF)	64			
	βc/βd	2/15	11/15	15/8	15/4
	βhs	4/15	24/15	30/15	30/15
	MPR (dB)	0	0	0.5	0.5
HSDPA Specific Settings	DACK	8			
	DNAK	8			
	DCQI	8			
	Ack-Nack Repetition factor	3			
	CQI Feedback	4ms			
	CQI Repetition Factor	2			
	Ahs = βhs/ βc	30/15			

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.

This report shall not be reproduced without the written approval of UL Verification Services Inc.

Measured Results

Band	Mode		UL Ch No.	Freq. (MHz)	MPR (dB)	Avg Pwr (dBm)	
						Max	Pwr Back-off
W-CDMA Band V	Rel 99	RMC, 12.2 kbps	4132	826.4	N/A	22.7	17.5
			4183	836.6	N/A	22.7	17.6
			4233	846.6	N/A	22.6	17.6
	HSDPA	Subtest 1	4132	826.4	0	22.6	17.5
			4183	836.6	0	22.5	17.6
			4233	846.6	0	22.5	17.6
		Subtest 2	4132	826.4	0	22.6	17.5
			4183	836.6	0	22.6	17.6
			4233	846.6	0	22.5	17.5
		Subtest 3	4132	826.4	0.5	21.1	16.1
			4183	836.6	0.5	21.1	16.1
			4233	846.6	0.5	21.1	16.1
		Subtest 4	4132	826.4	0.5	21.1	16.1
			4183	836.6	0.5	21.2	16.1
			4233	846.6	0.5	21.2	16.1
	HSUPA	Subtest 1	4132	826.4	0	21.1	16.4
			4183	836.6	0	21.0	16.4
			4233	846.6	0	21.0	16.5
		Subtest 2	4132	826.4	2	19.9	15.0
			4183	836.6	2	21.0	14.9
			4233	846.6	2	21.0	15.0
		Subtest 3	4132	826.4	1	20.5	15.2
			4183	836.6	1	20.4	15.4
			4233	846.6	1	20.4	15.5
		Subtest 4	4132	826.4	2	21.0	16.0
			4183	836.6	2	20.9	15.5
			4233	846.6	2	21.0	16.0
		Subtest 5	4132	826.4	0	22.4	17.6
			4183	836.6	0	22.5	17.7
			4233	846.6	0	22.3	17.7
	DC-HSPA	Subtest 1	4132	826.4	0	22.6	17.6
			4183	836.6	0	22.5	17.6
			4233	846.6	0	22.5	17.6
		Subtest 2	4132	826.4	0	22.6	17.5
			4183	836.6	0	22.5	17.6
			4233	846.6	0	22.5	17.6
		Subtest 3	4132	826.4	0.5	21.0	16.0
			4183	836.6	0.5	21.0	16.1
			4233	846.6	0.5	21.2	16.1
		Subtest 4	4132	826.4	0.5	21.1	16.0
			4183	836.6	0.5	21.0	16.1
			4233	846.6	0.5	21.0	16.1

This report shall not be reproduced without the written approval of UL Verification Services Inc.

Band	Mode		UL Ch No.	Freq. (MHz)	MPR (dB)	Avg Pwr (dBm)	
						Max	Pwr Back-off
W-CDMA Band II	Rel 99	RMC, 12.2 kbps	9262	1852.4	N/A	22.4	12.1
			9400	1880.0	N/A	22.7	12.3
			9538	1907.6	N/A	22.4	11.4
	HSDPA	Subtest 1	9262	1852.4	0	22.5	12.0
			9400	1880.0	0	22.7	12.0
			9538	1907.6	0	22.5	11.5
		Subtest 2	9262	1852.4	0	22.6	12.0
			9400	1880.0	0	22.7	12.2
			9538	1907.6	0	22.5	11.4
		Subtest 3	9262	1852.4	0.5	22.5	10.6
			9400	1880.0	0.5	22.5	10.5
			9538	1907.6	0.5	22.5	10.0
		Subtest 4	9262	1852.4	0.5	22.5	10.6
			9400	1880.0	0.5	22.5	10.5
			9538	1907.6	0.5	22.5	10.0
	HSUPA	Subtest 1	9262	1852.4	0	21.0	11.2
			9400	1880.0	0	22.0	11.0
			9538	1907.6	0	22.2	10.5
		Subtest 2	9262	1852.4	2	21.0	9.5
			9400	1880.0	2	19.9	9.5
			9538	1907.6	2	19.7	9.3
		Subtest 3	9262	1852.4	1	20.4	9.9
			9400	1880.0	1	20.5	10.0
			9538	1907.6	1	20.4	9.5
		Subtest 4	9262	1852.4	2	21.0	10.0
			9400	1880.0	2	21.0	10.5
			9538	1907.6	2	20.9	10.0
		Subtest 5	9262	1852.4	0	22.3	11.0
			9400	1880.0	0	22.3	11.2
			9538	1907.6	0	22.1	11.0
	DC-HSPA	Subtest 1	9262	1852.4	0	22.5	12.1
			9400	1880.0	0	22.8	12.1
			9538	1907.6	0	22.5	11.5
		Subtest 2	9262	1852.4	0	22.5	12.0
			9400	1880.0	0	22.7	12.0
			9538	1907.6	0	22.4	11.5
		Subtest 3	9262	1852.4	0.5	21.0	10.7
			9400	1880.0	0.5	20.7	10.6
			9538	1907.6	0.5	21.0	10.0
		Subtest 4	9262	1852.4	0.5	21.0	10.6
			9400	1880.0	0.5	21.5	10.5
			9538	1907.6	0.5	21.0	10.0

This report shall not be reproduced without the written approval of UL Verification Services Inc.

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 Signaling 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.					

This report shall not be reproduced without the written approval of UL Verification Services Inc.

LTE Band 5 Measured Results

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)					
							Max. Power			with Pwr Back-off		
							829 MHz	836.5 MHz	844 MHz	829 MHz	836.5 MHz	844 MHz
LTE Band 5	10	QPSK	1	0	0	0	22.9	22.9	22.9	18.4	18.4	18.4
			1	25	0	0	22.6	22.9	22.8	18.5	18.2	18.4
			1	49	0	0	22.9	22.9	22.9	18.2	18.3	18.3
			25	0	1	1	21.5	21.7	21.6	17.2	17.2	17.2
			25	12	1	1	21.7	21.6	21.5	17.1	17.1	17.1
			25	25	1	1	21.5	21.6	21.5	17.0	17.1	17.0
			50	0	1	1	21.5	21.6	21.6	17.2	17.2	17.1
		16QAM	1	0	1	1	21.6	21.3	21.8	17.1	17.1	17.1
			1	25	1	1	21.4	21.4	22.0	17.2	17.2	17.2
			1	49	1	2	21.3	21.4	21.0	17.2	17.2	17.2
			25	0	2	2	20.5	20.7	21.0	16.2	16.2	16.2
			25	12	2	2	20.4	20.9	20.6	16.1	16.1	16.1
			25	25	2	2	20.3	20.6	20.6	16.1	16.1	16.1
			50	0	2	2	20.5	20.6	20.6	16.0	16.0	16.0

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)					
							Max. Power			with Pwr Back-off		
							826.5 MHz	836.5 MHz	846.5 MHz	826.5 MHz	836.5 MHz	846.5 MHz
LTE Band 5	5	QPSK	1	0	0	0	22.7	22.5	22.5	18.2	17.9	18.1
			1	12	0	0	22.7	22.6	22.6	18.1	18.2	18.1
			1	24	0	0	22.6	22.2	22.5	17.8	17.8	17.9
			12	0	1	1	21.4	21.7	21.7	17.0	17.1	17.1
			12	7	1	1	21.7	21.6	21.6	17.0	17.1	17.0
			12	13	1	1	21.5	21.5	21.5	16.9	17.0	16.9
			25	0	1	1	21.6	21.5	21.3	17.1	17.1	17.0
		16QAM	1	0	1	1	21.4	21.5	21.3	17.0	17.0	17.0
			1	12	1	1	21.3	21.4	21.4	17.0	17.0	17.0
			1	24	1	2	21.2	21.1	21.1	17.0	17.0	17.0
			12	0	2	2	20.6	20.8	20.6	16.1	16.1	16.1
			12	7	2	2	20.6	20.8	20.6	16.0	16.0	16.0
			12	13	2	2	20.6	20.5	20.5	15.9	16.0	16.0
			25	0	2	2	20.6	20.8	20.8	16.0	16.0	16.0

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)					
							Max. Power			with Pwr Back-off		
							825.5 MHz	836.5 MHz	847.5 MHz	825.5 MHz	836.5 MHz	847.5 MHz
LTE Band 5	3	QPSK	1	0	0	0	22.4	22.5	22.4	18.1	18.2	18.1
			1	8	0	0	22.5	22.6	22.6	18.1	18.0	18.0
			1	14	0	0	22.5	22.6	22.5	18.0	18.3	18.0
			8	0	1	1	21.0	21.1	21.2	17.1	17.1	17.0
			8	4	1	1	21.3	21.1	21.2	17.0	17.0	17.0
			8	7	1	1	21.4	21.4	21.3	17.0	17.0	16.9
			15	0	1	1	21.4	21.3	21.3	17.0	17.0	17.0
		16QAM	1	0	1	1	21.4	21.6	21.3	16.9	17.0	17.0
			1	8	1	1	21.3	21.2	21.2	17.0	17.0	16.9
			1	14	1	1	21.2	21.2	21.1	17.0	17.0	17.0
			8	0	2	2	20.6	20.8	20.6	16.2	16.2	16.2
			8	4	2	2	20.5	20.7	20.5	16.0	16.1	16.1
			8	7	2	2	20.5	20.5	20.5	16.1	16.1	16.1
			15	0	2	2	20.5	20.6	20.7	16.0	16.0	16.0

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)					
							Max. Power			with Pwr Back-off		
							824.7 MHz	836.5 MHz	848.3 MHz	824.7 MHz	836.5 MHz	848.3 MHz
LTE Band 5	1.4	QPSK	1	0	0	0	22.7	22.5	22.5	18.0	18.1	18.0
			1	3	0	0	22.7	22.6	22.7	18.0	18.0	18.0
			1	5	0	0	22.7	22.7	22.5	17.9	18.0	17.9
			3	0	0	0	22.6	22.5	22.6	18.0	18.1	18.0
			3	1	0	0	22.6	22.5	22.6	18.0	18.0	18.0
			3	3	0	0	22.5	22.5	22.5	18.0	18.0	17.9
			6	0	1	1	21.6	21.5	21.3	17.0	17.1	17.0
		16QAM	1	0	1	1	21.3	21.3	21.3	17.0	17.0	17.0
			1	3	1	1	21.3	21.4	21.3	16.9	16.9	16.9
			1	5	1	2	21.2	21.2	21.1	17.0	17.0	17.0
			3	0	1	1	21.4	21.3	21.3	16.9	17.0	17.0
			3	1	1	1	21.2	21.4	21.4	17.0	17.0	17.0
			3	3	1	1	21.2	21.2	21.4	16.9	17.0	17.0
			6	0	2	2	20.9	20.6	20.8	16.0	16.0	16.0

This report shall not be reproduced without the written approval of UL Verification Services Inc.

9.4. Wi-Fi 2.4GHz

Max Power

Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	Avg Pwr (dBm)	Max Output Power (dBm)	SAR Test (Yes/No)	Note(s)
2.4	802.11b	1 Mbps	1	2412	16.4	16.5	Yes	
			6	2437	16.1			
			11	2462	16.2			
	802.11g	6 Mbps	1	2412	Not Required	13.5	No	1
			6	2437				
			11	2462				
	802.11n (HT20)	6.5 Mbps	1	2412		12.5	No	1
			6	2437				
			11	2462				

With Power Back-Off

Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	Avg Pwr (dBm)	Max Output Power (dBm)	SAR Test (Yes/No)	Note(s)
2.4	802.11b	1 Mbps	1	2412	11.2	11.5	Yes	
			6	2437	11.0			
			11	2462	11.0			
	802.11g	6 Mbps	1	2412	Not Required	11.5	No	1
			6	2437				
			11	2462				
	802.11n (HT20)	6.5 Mbps	1	2412		11.5	No	1
			6	2437				
			11	2462				

Note(s):

1. Output Power and SAR is not required for 802.11g/n HT20 channels when the highest *reported* SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.

This report shall not be reproduced without the written approval of UL Verification Services Inc.

9.5. Wi-Fi 5GHz

Max Power

Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	Avg Pwr (dBm)	Max Output Power (dBm)	SAR Test (Yes/No)	Note(s)
5.2 (U-NII 1)	802.11a	6 Mbps	36	5180	11.2	11.5	No	3
			40	5200	11.3			
			44	5220	11.4			
			48	5240	10.9			
	802.11n (HT20)	6.5 Mbps	36	5180	11.2	11.5	No	3
			40	5200	11.3			
			44	5220	11.3			
			48	5240	10.9			
	802.11n (HT40)	13.5 Mbps	38-46	5190 - 5230	Not Required	9.5	No	1
5.3 (U-NII 2A)	802.11a	6 Mbps	52	5260	11.1	11.5	Yes	
			56	5280	11.5			
			60	5300	10.8			
			64	5320	10.7			
	802.11n (HT20)	6.5 Mbps	52	5260	11.2	11.5	No	2
			56	5280	11.4			
			60	5300	10.8			
			64	5320	10.9			
	802.11n (HT40)	13.5 Mbps	54-62	5270 - 5310	Not Required	9.5	No	1
5.5 (U-NII 2C)	802.11a	6 Mbps	100	5500	11.3	11.5	Yes	
			116	5580	11.3			
			140	5700	10.7			
	802.11n (HT20)	6.5 Mbps	100	5500	11.0	11.5	No	2
			116	5580	11.0			
			140	5700	10.8			
	802.11n (HT40)	13.5 Mbps	102-134	5510-5670	Not Required	9.5	No	1
5.8 (U-NII 3)	802.11a	6 Mbps	149	5745	11.1	11.5	Yes	
			157	5785	11.2			
			165	5825	11.5			
	802.11n (HT20)	6.5 Mbps	149	5745	11.5	11.5	No	2
			157	5785	11.1			
			165	5825	11.2			
	802.11n (HT40)	13.5 Mbps	151-159	5755-5795	Not Required	9.5	No	1

Note(s):

1. Output Power and SAR is not required for 802.11n HT20/HT40 channels when the specified tune-up tolerances for 802.11n HT20/HT40 are lower than 802.11a by more than ½ dB and the measured SAR is ≤ 1.2 W/Kg.
2. When the same transmission mode configurations have the same maximum output power on the same channel for the 802.11 a/g/n/ac modes, the channel in the lower order/sequence 802.11 mode (i.e. a, g, n then ac) is selected.
3. When the specified maximum output power is the same for both UNII band I and UNII band 2A, begin SAR measurement in UNII band 2A; and if the highest *reported* SAR for UNII band 2A is
   - ≤ 1.2 W/kg, SAR is not required for UNII band I
   - > 1.2 W/kg, both bands should be tested independently for SAR.

This report shall not be reproduced without the written approval of UL Verification Services Inc.

With Power Back-Off

Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	Avg Pwr (dBm)	Max Output Power (dBm)	SAR Test (Yes/No)	Note(s)
5.2 (U-NII 1)	802.11a	6 Mbps	36-48	5180-5240	Not Required	6.5	No	
	802.11n (HT20)	6.5 Mbps	36-48	5180 - 5240		6.5	No	
	802.11n (HT40)	13.5 Mbps	38	5190		6.5	No	
			46	5230				
5.3 (U-NII 2A)	802.11a	6 Mbps	52-64	5260-5320	Not Required	6.5	No	
	802.11n (HT20)	6.5 Mbps	52-64	5260 - 5320		6.5	No	
	802.11n (HT40)	13.5 Mbps	54	5270	6.4	6.5	Yes	
			62	5310	6.3			
5.5 (U-NII 2C)	802.11a	6 Mbps	100-140	5500-5700	Not Required	6.5	No	
	802.11n (HT20)	6.5 Mbps	100-140	5500-5700		6.5	No	
	802.11n (HT40)	13.5 Mbps	102	5510	6.4	6.5	Yes	
			110	5550	6.4			
			134	5670	6.2			
5.8 (U-NII 3)	802.11a	6 Mbps	149-165	5745-5825	Not Required	6.5	No	
	802.11n (HT20)	6.5 Mbps	149-165	5745-5825		6.5	No	
	802.11n (HT40)	13.5 Mbps	151	5755	6.4	6.5	Yes	
			159	5795	6.3			

Note(s):

1. Output Power and SAR is not required for 802.11a and 802.11n HT20 channels because the specified tune-up tolerances for 802.11a and 802.11n HT20 are lower than or equal to 802.11n HT40 and the measured SAR is ≤ 1.2 W/Kg.
2. When the specified maximum output power is the same for both UNII band I and UNII band 2A, begin SAR measurement in UNII band 2A; and if the highest *reported* SAR for UNII band 2A is
   a. ≤ 1.2 W/kg, SAR is not required for UNII band I
   b. > 1.2 W/kg, both bands should be tested independently for SAR.

9.6. Bluetooth

Band (GHz)	Mode	Ch #	Freq. (MHz)	Avg Pwr (dBm)
2.4	V3.0 + EDR, GFSK	0	2402	9.5
		39	2441	9.5
		78	2480	9.8
	V3.0 + EDR, π/4 DQPSK	0	2402	6.0
		39	2441	6.3
		78	2480	6.8
	V3.0 + EDR, 8-DPSK	0	2402	6.2
		39	2441	6.3
		78	2480	6.9
	V4.0 LE, GFSK	0	2402	0.9
		19	2440	0.9
		39	2480	0.8

This report shall not be reproduced without the written approval of UL Verification Services Inc.

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 941225 D01 SAR test for 3G devices:
When the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤ ¼ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode

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 meas for 802.11 v02:
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.

This report shall not be reproduced without the written approval of UL Verification Services Inc.

- 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*.

This report shall not be reproduced without the written approval of UL Verification Services Inc.

10.1. GSM850

RF Exposure Conditions	Mode	Pwr Back Off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
							Tune-up limit	Meas.	Meas.	Scaled	
Head	Voice	Off	0	Left Touch	190	836.6	33.0	32.5	0.063	0.071	
				Left Tilt	190	836.6	33.0	32.5	0.096	0.108	
				Right Touch	190	836.6	33.0	32.5	0.048	0.054	
				Right Tilt	190	836.6	33.0	32.5	0.089	0.100	
Head VoIP	GPRS 3 Slots	Off	0	Left Touch	190	836.6	30.0	29.5	0.087	0.098	
				Left Tilt	190	836.6	30.0	29.5	0.140	0.157	1
				Right Touch	190	836.6	30.0	29.5	0.069	0.077	
				Right Tilt	190	836.6	30.0	29.5	0.134	0.150	
Body	Voice	Off	20	Rear	190	836.6	33.0	32.5	0.247	0.277	
	GPRS 3 Slots		20	Rear	190	836.6	30.0	29.5	0.396	0.444	
			8	Edge 2	190	836.6	30.0	29.5	0.277	0.311	
			15	Edge 3	190	836.6	30.0	29.5	0.025	0.028	
	Voice	On	0	Rear	128	824.2	29.0	28.3	0.844	0.992	
					190	836.6	29.0	28.5	0.880	0.987	
					251	848.8	29.0	28.5	0.891	1.000	
	GPRS 3 Slots		0	Rear	190	836.6	24.5	24.1	0.736	0.807	
				Edge 2	190	836.6	24.5	24.1	0.261	0.286	
				Edge 3	190	836.6	24.5	24.1	0.343	0.376	
	EGPRS 4 Slots		0	Rear	128	824.2	23.5	23.2	0.990	1.061	
					190	836.6	23.5	23.5	1.030	1.030	
					251	848.8	23.5	23.4	1.050	1.074	2
				Edge 2	190	836.6	23.5	23.5	0.339	0.339	
				Edge 3	190	836.6	23.5	23.5	0.402	0.402	

10.2. GSM1900

RF Exposure Conditions	Mode	Pwr Back Off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
							Tune-up limit	Meas.	Meas.	Scaled	
Head	Voice	Off	0	Left Touch	661	1880.0	30.0	30.0	0.023	0.023	
				Left Tilt	661	1880.0	30.0	30.0	0.021	0.021	
				Right Touch	661	1880.0	30.0	30.0	0.046	0.046	
				Right Tilt	661	1880.0	30.0	30.0	0.018	0.018	
Head VoIP	GPRS 3 Slots	Off	0	Left Touch	661	1880.0	27.0	26.5	0.022	0.025	
				Left Tilt	661	1880.0	27.0	26.5	0.022	0.025	
				Right Touch	661	1880.0	27.0	26.5	0.048	0.054	3
				Right Tilt	661	1880.0	27.0	26.5	0.019	0.021	
Body	Voice	Off	20	Rear	661	1880.0	30.0	30.0	0.313	0.313	
	GPRS 3 Slots		20	Rear	661	1880.0	27.0	26.5	0.323	0.362	
			8	Edge 2	661	1880.0	27.0	26.5	0.150	0.168	
			15	Edge 3	661	1880.0	27.0	26.5	0.394	0.442	
	Voice	On	0	Rear	512	1850.2	22.0	21.3	0.849	0.997	
					661	1880.0	22.0	21.4	0.832	0.955	
					810	1909.8	22.0	21.2	0.829	0.997	
	GPRS 4 Slots		0	Rear	512	1850.2	16.0	15.9	0.956	0.978	
					661	1880.0	16.0	15.9	1.070	1.095	4
					810	1909.8	16.0	15.9	1.020	1.044	
			0	Edge 2	661	1880.0	16.0	15.4	0.119	0.137	
			0	Edge 3	661	1880.0	16.0	15.4	0.693	0.796	

This report shall not be reproduced without the written approval of UL Verification Services Inc.

10.3. W-CDMA Band V

RF Exposure Conditions	Mode	Pwr Back Off	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	Off	0	Left Touch	4183	836.6	23.0	22.7	0.058	0.062	
				Left Tilt	4183	836.6	23.0	22.7	0.080	0.086	5
				Right Touch	4183	836.6	23.0	22.7	0.053	0.057	
				Right Tilt	4183	836.6	23.0	22.7	0.078	0.084	
Body	Rel.99 RMC	Off	20	Rear	4183	836.6	23.0	22.7	0.246	0.264	
			8	Edge 2	4183	836.6	23.0	22.7	0.174	0.186	
			15	Edge 3	4183	836.6	23.0	22.7	0.017	0.018	
	Rel.99 RMC	On	0	Rear	4132	826.4	18.0	17.5	0.884	0.992	6
					4183	836.6	18.0	17.6	0.877	0.962	
					4233	846.6	18.0	17.6	0.873	0.957	
				Edge 2	4183	836.6	18.0	17.6	0.203	0.223	
				Edge 3	4183	836.6	18.0	17.6	0.311	0.341	

10.4. W-CDMA Band II

RF Exposure Conditions	Mode	Pwr Back Off	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	Off	0	Left Touch	9400	1880.0	23.0	22.7	0.040	0.043	
				Left Tilt	9400	1880.0	23.0	22.7	0.040	0.043	
				Right Touch	9400	1880.0	23.0	22.7	0.084	0.090	7
				Right Tilt	9400	1880.0	23.0	22.7	0.034	0.036	
Body	Rel.99 RMC	Off	20	Rear	9400	1880.0	23.0	22.7	0.577	0.618	
			8	Edge 2	9400	1880.0	23.0	22.7	0.237	0.254	
			15	Edge 3	9400	1880.0	23.0	22.7	0.615	0.659	
	Rel.99 RMC	On	0	Rear	9400	1880.0	12.5	12.3	0.755	0.791	8
				Edge 2	9400	1880.0	12.5	12.3	0.105	0.110	
				Edge 3	9400	1880.0	12.5	12.3	0.624	0.653	

10.5. LTE Band 5 (10MHz Bandwidth)

RF Exposure Conditions	Mode	Pwr Back Off	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	Off	0	Left Touch	20525	836.5	1	0	23.0	22.9	0.053	0.054	
							25	0	22.0	21.7	0.040	0.043	
				Left Tilt	20525	836.5	1	0	23.0	22.9	0.094	0.096	9
							25	0	22.0	21.7	0.070	0.075	
				Right Touch	20525	836.5	1	0	23.0	22.9	0.068	0.070	
							25	0	22.0	21.7	0.053	0.057	
				Right Tilt	20525	836.5	1	0	23.0	22.9	0.091	0.093	
							25	0	22.0	21.7	0.071	0.076	
Body	QPSK	Off	20	Rear	20525	836.5	1	0	23.0	22.9	0.230	0.235	
							25	0	22.0	21.7	0.174	0.186	
			8	Edge 2	20525	836.5	1	0	23.0	22.9	0.186	0.190	
							25	0	22.0	21.7	0.142	0.152	
			15	Edge 3	20525	836.5	1	0	23.0	22.9	0.187	0.191	
							25	0	22.0	21.7	0.143	0.153	
		On	0	Rear	20450	829.0	1	0	18.5	18.4	1.040	1.064	
					20525	836.6	1	0	18.5	18.4	1.070	1.095	10
							25	0	17.5	17.2	0.730	0.782	
					20600	844.0	1	0	18.5	18.4	0.950	0.972	
				Edge 2	20525	836.5	1	0	18.5	18.4	0.226	0.231	
							25	0	17.5	17.2	0.174	0.186	
				Edge 3	20525	836.5	1	0	18.5	18.4	0.300	0.307	
							25	0	17.5	17.2	0.217	0.233	

This report shall not be reproduced without the written approval of UL Verification Services Inc.

10.6. Wi-Fi (DTS Band)

RF Exposure Conditions	Frequency Band	Mode	Pwr Back Off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Power (dBm)		1-g SAR (W/kg)		Notes	Plot No.
									Tune-up limit	Meas.	Meas.	Scaled		
Head	2.4GHz	802.11b 1 Mbps	Off	0	Left Touch	1	2412	0.601	16.5	16.4	0.513	0.525	2	11
					Left Tilt	1	2412	0.484	16.5	16.4	0.394	0.403		
					Right Touch	1	2412	0.137	16.5	16.4				
					Right Tilt	1	2412	0.116	16.5	16.4				
Body			Off	13	Rear	1	2412	0.440	16.5	16.4	0.359	0.367	1	12
				11	Edge 1	1	2412	0.062	16.5	16.4				
				0	Edge 2	1	2412	0.382	16.5	16.4				
			On	0	Rear	1	2412	0.531	11.5	11.2	0.340	0.364	1	
					Edge 1	1	2412	0.054	11.5	11.2				

Note(s):

1. Highest *reported* SAR is ≤ 0.4 W/kg. Therefore, further SAR measurements within this exposure condition are not required.
2. Highest *reported* SAR is > 0.4 W/kg. Due to the highest *reported* SAR for this test position, other test positions in this exposure condition were evaluated until a SAR ≤ 0.8 W/kg was *reported*.
3. Testing for a second channel was required because the *reported* SAR for this test position was >0.8 W/kg.
4. Additional testing required in order satisfying FCC simultaneous transmission limit criteria.

10.7. Wi-Fi (U-NII Band)

RF Exposure Conditions	Frequency Band	Mode	Pwr Back Off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Power (dBm)		1-g SAR (W/kg)		Notes	Plot No.
									Tune-up limit	Meas.	Meas.	Scaled		
Head	5.3 GHz U-NII 2A	802.11a 6 Mbps	Off	0	Left Touch	56	5280	0.680	11.5	11.5	0.419	0.419		
					Left Tilt	56	5280	0.716	11.5	11.5	0.420	0.420	2	13
					Right Touch	56	5280	0.279	11.5	11.5				
					Right Tilt	56	5280	0.328	11.5	11.5				
Body			Off	13	Rear	56	5280	0.279	11.5	11.4				
				11	Edge 1	56	5280	0.411	11.5	11.4	0.245	0.251	1	
				0	Edge 2	56	5280	0.100	11.5	11.4				
		802.11n (HT40)	On	0	Rear	54	5270	0.826	6.5	6.4	0.384	0.393	1	14
					Edge 1	54	5270	0.238	6.5	6.4				
RF Exposure Conditions	Frequency Band	Mode	Pwr Back Off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Power (dBm)		1-g SAR (W/kg)		Notes	Plot No.
									Tune-up limit	Meas.	Meas.	Scaled		
Head	5.5 GHz U-NII 2C	802.11a 6 Mbps	Off	0	Left Touch	100	5500	1.010	11.5	11.3	0.605	0.634		
						116	5580	1.360	11.5	11.3	0.787	0.824	3	15
					Left Tilt	116	5580	1.270	11.5	11.3	0.741	0.776	2	
					Right Touch	116	5580	0.451	11.5	11.3				
					Right Tilt	116	5580	0.545	11.5	11.3				
Body			Off	13	Rear	116	5580	0.670	11.5	11.3	0.392	0.410		
				11	Edge 1	116	5580	0.844	11.5	11.3	0.467	0.489	2	16
				0	Edge 2	116	5580	0.391	11.5	11.3				
		802.11n (HT40)	On	0	Rear	110	5550	0.676	6.5	6.4	0.362	0.370	1	
					Edge 1	110	5550	0.233	6.5	6.4				
RF Exposure Conditions	Frequency Band	Mode	Pwr Back Off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Power (dBm)		1-g SAR (W/kg)		Notes	Plot No.
									Tune-up limit	Meas.	Meas.	Scaled		
Head	5.8 GHz U-NII 3	802.11a 6 Mbps	Off	0	Left Touch	165	5825	0.898	11.5	11.5	0.473	0.473		
					Left Tilt	165	5825	0.926	11.5	11.5	0.505	0.505	2	17
					Right Touch	165	5825	0.461	11.5	11.5				
					Right Tilt	165	5825	0.651	11.5	11.5				
Body			Off	13	Rear	165	5825	0.260	11.5	11.5				
				11	Edge 1	165	5825	0.596	11.5	11.5	0.346	0.346	1	
				0	Edge 2	165	5825	0.343	11.5	11.5				
		802.11n (HT40)	On	0	Rear	151	5755	0.807	6.5	6.4	0.351	0.359	1	18
					Edge 1	151	5755	0.259	6.5	6.4				

Note(s):

1. Highest *reported* SAR is ≤ 0.4 W/kg. Therefore, further SAR measurements within this exposure condition are not required.
2. Highest *reported* SAR is > 0.4 W/kg. Due to the highest *reported* SAR for this test position, other test positions in this exposure condition were evaluated until a SAR ≤ 0.8 W/kg was *reported*.
3. Testing for a second channel was required because the *reported* SAR for this test position was >0.8 W/kg.
4. Additional testing required in order satisfying FCC simultaneous transmission limit criteria.

This report shall not be reproduced without the written approval of UL Verification Services Inc.

10.8. Bluetooth

Frequency Band	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
2.4 GHz	GFSK	0	Rear	39	2441.0	10.5	9.5	0.338	0.426	19

This report shall not be reproduced without the written approval of UL Verification Services Inc.

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
850	GSM 850	Standalone	Rear	No	1.05	N/A	N/A
	WCDMA Band V	Standalone	Rear	No	0.884	N/A	N/A
	LTE Band 5	Standalone	Rear	Yes	1.07	1.03	1.04
1900	GSM 1900	Standalone	Rear	Yes	1.07	1.06	1.01
	WCDMA Band II	Standalone	Rear	No	0.755	N/A	N/A
2400	Wi-Fi 802.11b/g/n	Standalone	Left Touch	No	0.513	N/A	N/A
	Bluetooth	Standalone	Rear	No	0.338	N/A	N/A
5300	Wi-Fi 802.11a/n/ac	Standalone	Left Touch	No	0.420	N/A	N/A
5600	Wi-Fi 802.11a/n/ac	Standalone	Left Touch	No	0.787	N/A	N/A
5800	Wi-Fi 802.11a/n/ac	Standalone	Rear	No	0.505	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.

This report shall not be reproduced without the written approval of UL Verification Services Inc.

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				
Standalone	1	GSM(GPRS/EDGE)	+	DTS		
	2	GSM(GPRS/EDGE)	+	U-NII		
	3	GSM(GPRS/EDGE)	+	BT		
	4	GSM(GPRS/EDGE)	+	U-NII	+	BT
	5	W-CDMA	+	DTS		
	6	W-CDMA	+	U-NII		
	7	W-CDMA	+	BT		
	8	W-CDMA	+	U-NII	+	BT
	9	LTE	+	DTS		
	10	LTE	+	U-NII		
	11	LTE	+	BT		
	12	LTE	+	U-NII	+	BT

Notes:

1. Only DTS supports Hotspot.
2. GPRS/EDGE, W-CDMA, CDMA and LTE support Hotspot.
3. VoIP is supported in GPRS/EDGE, W-CDMA, CDMA and LTE.
4. DTS Radio cannot transmit simultaneously with Bluetooth Radio.
5. U-NII Radio can transmit simultaneously with Bluetooth Radio.

This report shall not be reproduced without the written approval of UL Verification Services Inc.

Estimated SAR for Simultaneous Transmission SAR Analysis

Considerations for SAR estimation

1. When standalone SAR test exclusion applies, standalone SAR must also be estimated to determine simultaneous transmission SAR test exclusion.
2. Dedicated Host Approach criteria for SAR test exclusion is likewise applied to SAR estimation, with certain distinctions between test exclusion and SAR estimation:
   - When the separation distance from the antenna to an adjacent edge is ≤ 5 mm, a distance of 5 mm is applied for SAR estimation; this is the same between test exclusion and SAR estimation calculations.
   - When the separation distance from the antenna to an adjacent edge is > 5 mm but ≤ 50 mm, the actual antenna-to-edge separation distance is applied for SAR estimation.
   - When the minimum test separation distance is > 50 mm, the estimated SAR value is 0.4 W/kg
3. Please refer to Estimated SAR Tables to see which test positions are inherently compliant as they consist of only estimated SAR values for all applicable transmitters and consequently will always have sum of SAR values < 1.2 W/kg. Simultaneous transmission SAR analysis was therefore not performed for these test positions.

Estimated SAR for WWAN

Antenna	Tx Interface	Frequency (MHz)	Output Power		Separation Distances (mm)					Estimated 1-g SAR Value (W/kg)				
			dBm	mW	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Rear	Edge 1	Edge 2	Edge 3	Edge 4
Full Power														
Cellular	GPRS 3 Slots	824.2	30.00	375	17	195	7	13	93	-MEASURE-	0.400	-MEASURE-	-MEASURE-	0.400
Cellular	GPRS 2 Slots	1909.8	28.00	158	17	195	7	13	93	-MEASURE-	0.400	-MEASURE-	-MEASURE-	0.400
Cellular	W-CDMA V	836.6	23.00	200	17	195	7	13	93	-MEASURE-	0.400	-MEASURE-	-MEASURE-	0.400
Cellular	W-CDMA II	1907.6	23.00	200	17	195	7	13	93	-MEASURE-	0.400	-MEASURE-	-MEASURE-	0.400
Cellular	LTE Band 5	844	23.00	200	17	195	7	13	93	-MEASURE-	0.400	-MEASURE-	-MEASURE-	0.400
Power Back Off														
Cellular	GPRS 3 Slots	848.8	25.00	119	5	195	5	5	91	-MEASURE-	0.400	-MEASURE-	-MEASURE-	0.400
Cellular	GPRS 2 Slots	1909.8	19.50	22	5	195	5	5	91	-MEASURE-	0.400	-MEASURE-	-MEASURE-	0.400
Cellular	W-CDMA V	846.6	18.00	63	5	195	5	5	91	-MEASURE-	0.400	-MEASURE-	-MEASURE-	0.400
Cellular	W-CDMA II	1907.6	12.50	18	5	195	5	5	91	-MEASURE-	0.400	-MEASURE-	-MEASURE-	0.400
Cellular	LTE Band 5	844	20.50	112	5	195	5	5	91	-MEASURE-	0.400	-MEASURE-	-MEASURE-	0.400

Estimated SAR for WLAN

Tx Interface	Frequency (MHz)	Output Power		Separation Distances (mm)					Estimated 1-g SAR Value (W/kg)				
		dBm	mW	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Rear	Edge 1	Edge 2	Edge 3	Edge 4
Full Power													
Wi-Fi 2.4 GHz	2462	16.50	45	13	23	14.5	190	98	-MEASURE-	-MEASURE-	-MEASURE-	0.400	0.400
Wi-Fi 5.2 GHz	5180	11.50	14	13	23	14.5	190	98	0.327	0.185	0.283	0.400	0.400
Wi-Fi 5.3 GHz	5260	11.50	14	13	23	14.5	190	98	0.329	0.186	0.285	0.400	0.400
Wi-Fi 5.5 GHz	5580	11.50	14	13	23	14.5	190	98	0.339	0.192	0.294	0.400	0.400
Wi-Fi 5.8 GHz	5825	11.50	14	13	23	14.5	190	98	0.347	0.196	0.300	0.400	0.400
Bluetooth	2480	10.50	11	13	23	14.5	190	98	0.178	0.100	0.154	0.400	0.400
Power Back Off													
Wi-Fi 2.4 GHz	2462	11.50	14	5	12				-MEASURE-	0.244			
Wi-Fi 5.2 GHz	5180	6.50	4	5	12				0.243	0.101			
Wi-Fi 5.3 GHz	5260	6.50	4	5	12				0.245	0.102			
Wi-Fi 5.5 GHz	5580	6.50	4	5	12				0.252	0.105			
Wi-Fi 5.8 GHz	5825	6.50	4	5	12				0.257	0.107			

This report shall not be reproduced without the written approval of UL Verification Services Inc.

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

RF Exposure conditions	① WWAN	② DSSS	③ U-NII	④ BT	①+② WWAN +DSSS		①+③ WWAN + U-NII		①+④ WWAN +BT	
					∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)	∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)	∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)
Left Touch	0.098	0.525	0.824		0.623	No	0.922	No		
Left Tilt	0.157	0.403	0.776		0.560	No	0.933	No		
Right Touch	0.077	0.525	0.824		0.602	No	0.901	No		
Right Tilt	0.150	0.525	0.824		0.675	No	0.974	No		
Rear	1.074	0.367	0.410	0.426	1.441	No	1.484	No	1.500	No
Edge 1		0.367	0.489							
Edge 2	0.311	0.367	0.489		0.678	No	0.800	No		
Edge 3	0.376	0.367	0.489		0.743	No	0.865	No		
Edge 4		0.367	0.489							

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

RF Exposure conditions	① WWAN	② DSSS	③ U-NII	④ BT	①+② WWAN +DSSS		①+③ WWAN + U-NII		①+④ WWAN +BT	
					∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)	∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)	∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)
Left Touch	0.025	0.525	0.824		0.550	No	0.849	No		
Left Tilt	0.025	0.403	0.776		0.428	No	0.801	No		
Right Touch	0.054	0.525	0.824		0.579	No	0.878	No		
Right Tilt	0.021	0.525	0.824		0.546	No	0.845	No		
Rear	1.095	0.367	0.410	0.426	1.462	No	1.505	No	1.521	No
Edge 1		0.367	0.489							
Edge 2	0.168	0.367	0.489		0.535	No	0.657	No		
Edge 3	0.796	0.367	0.489		1.163	No	1.285	No		
Edge 4		0.367	0.489							

Conclusion:

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

This report shall not be reproduced without the written approval of UL Verification Services Inc.

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

RF Exposure conditions	① WWAN	② DSSS	③ U-NII	④ BT	①+② WWAN +DSSS		①+③ WWAN + U-NII		①+④ WWAN +BT	
					∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)	∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)	∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)
Left Touch	0.062	0.525	0.824		0.587	No	0.886	No		
Left Tilt	0.086	0.403	0.776		0.489	No	0.862	No		
Right Touch	0.057	0.525	0.824		0.582	No	0.881	No		
Right Tilt	0.084	0.525	0.824		0.609	No	0.908	No		
Rear	0.992	0.367	0.410	0.426	1.359	No	1.402	No	1.418	No
Edge 1		0.367	0.489							
Edge 2	0.223	0.367	0.489		0.590	No	0.712	No		
Edge 3	0.341	0.367	0.489		0.708	No	0.830	No		
Edge 4		0.367	0.489							

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

RF Exposure conditions	① WWAN	② DSSS	③ U-NII	④ BT	①+② WWAN +DSSS		①+③ WWAN + U-NII		①+④ WWAN +BT	
					∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)	∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)	∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)
Left Touch	0.043	0.525	0.824		0.568	No	0.867	No		
Left Tilt	0.043	0.403	0.776		0.446	No	0.819	No		
Right Touch	0.090	0.525	0.824		0.615	No	0.914	No		
Right Tilt	0.036	0.525	0.824		0.561	No	0.860	No		
Rear	0.791	0.367	0.410	0.426	1.158	No	1.201	No	1.217	No
Edge 1		0.367	0.489							
Edge 2	0.254	0.367	0.489		0.621	No	0.743	No		
Edge 3	0.659	0.367	0.489		1.026	No	1.148	No		
Edge 4		0.367	0.489							

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

RF Exposure conditions	① WWAN	② DSSS	③ U-NII	④ BT	①+② WWAN +DSSS		①+③ WWAN + U-NII		①+④ WWAN +BT	
					∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)	∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)	∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)
Left Touch	0.054	0.525	0.824		0.579	No	0.878	No		
Left Tilt	0.096	0.403	0.776		0.499	No	0.872	No		
Right Touch	0.070	0.525	0.824		0.595	No	0.894	No		
Right Tilt	0.093	0.525	0.824		0.618	No	0.917	No		
Rear	1.095	0.367	0.410	0.426	1.462	No	1.505	No	1.521	No
Edge 1		0.367	0.489							
Edge 2	0.231	0.367	0.489		0.598	No	0.720	No		
Edge 3	0.307	0.367	0.489		0.674	No	0.796	No		
Edge 4		0.367	0.489							

Conclusion:

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

This report shall not be reproduced without the written approval of UL Verification Services Inc.

Appendixes

Refer to separated files for the following appendixes.

A_15I19962v0 SAR Photos & Ant. Locations

B_15I19962v0 SAR Highest Test Plots

C_15I19962v0 SAR System Check Plots

D_15I19962v0 SAR Tissue Ingredients

E_15I19962v0 SAR Probe Cal. Certificates

F_15I19962v0 SAR Dipole Cal. Certificates

END OF REPORT

This report shall not be reproduced without the written approval of UL Verification Services Inc.