



SAR EVALUATION REPORT

**FCC 47 CFR § 2.1093
IEEE Std 1528-2013**

For
GSM/WCDMA/LTE Phone + Bluetooth, DTS/UNII a/b/g/n, ANT+ and NFC

**Model: SM-A500FU
FCC ID: A3LSMA500FU**

**Report Number: 14U19260-S1A
Issue Date: 12/1/2014**

Prepared for
**SAMSUNG ELECTRONICS CO., LTD.
416, MAETAN 3-DONG, YEONGTONG-GU
SUWON-CITY, 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.	Issue Date	Revisions	Revised By
--	11/25/2014	Initial Issue	--
A	12/1/2014	Appendix A: Updated Main Antenna technologies Section 8.2: Updated WCDMA Band V HSUPA power Section 8.4-5: Added notes for testing justification Section 12: Updated repeated measurement limit	Coltyce Sanders

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 Procedure..... 8
 - 4.3. Test Equipment..... 10
- 5. Measurement Uncertainty 10**
- 6. Device Under Test (DUT) Information 11**
 - 6.1. DUT Description 11
 - 6.2. Wireless Technologies..... 11
 - 6.3. Nominal and Maximum Output Power 12
 - 6.4. Simultaneous Transmission Condition..... 13
 - 6.5. General LTE SAR Test and Reporting Considerations..... 13
- 7. RF Exposure Conditions (Test Configurations) 14**
- 8. Conducted Output Power Measurements..... 15**
 - 8.1. GSM850 and GSM1900..... 15
 - 8.2. WCDMA Band V and II 17
 - 8.3. LTE Band 5..... 21
 - 8.4. Wi-Fi (2.4 GHz Band)..... 24
 - 8.5. Wi-Fi (5 GHz Bands)..... 25
 - 8.6. Bluetooth..... 26
- 9. Dielectric Property Measurements 27**
 - 9.1. Tissue Dielectric Parameters 27
 - 9.2. Dielectric Property Measurements Results..... 28
- 10. System Check..... 30**
 - 10.1. System Performance Check Measurement Conditions 30
 - 10.2. Reference Target SAR Values..... 31
 - 10.3. System Check Results..... 32
- 11. Measured and Reported (Scaled) SAR Results..... 34**
 - 11.1. GSM850..... 35
 - 11.2. GSM1900..... 35

11.3. WCDMA Band V 35

11.4. WCDMA Band II 36

11.5. LTE Band 5 (10MHz Bandwidth) 36

11.6. Wi-Fi 2.4 GHz Band (DTS) 36

11.7. Wi-Fi (UNII Band)..... 37

11.8. Bluetooth..... 38

 11.8.1. Standalone SAR Test Exclusion Considerations 38

 11.8.2. Estimated SAR..... 38

12. SAR Measurement Variability 39

13. Simultaneous Transmission SAR Analysis 40

 13.1. Sum of the SAR for GSM850 & Wi-Fi & BT 40

 13.2. Sum of the SAR for GSM1900 & Wi-Fi & BT 40

 13.3. Sum of the SAR for WCDMA Band V & Wi-Fi & BT 41

 13.4. Sum of the SAR for WCDMA Band II & Wi-Fi & BT 41

 13.5. Sum of the SAR for LTE Band 5 & Wi-Fi & BT 42

14. Appendixes 43

 A. Photos and Antenna Locations 43

 B. System Performance Check Plots 43

 C. Highest SAR Test Plots 43

 D. Tissue Material Ingredients..... 43

 E. Calibration Certificates for E-Field Probes..... 43

 F. Calibration Certificates for Dipoles..... 43

1. Attestation of Test Results



Applicant Name	SAMSUNG ELECTRONICS CO., LTD.
FCC ID	A3LSMA500FU
DUT Description	Phone with Bluetooth, DTS/UNII a/b/g/n, ANT+ & NFC
Exposure Category	General Population/Uncontrolled Exposure
Applicable Standards	FCC 47 CFR § 2.1093 Published RF exposure KDB procedures IEEE Std 1528-2013
Date tested	11/03/2014 – 11/20/2014

The Highest Reported SAR (W/kg)

RF Exposure Conditions	Equipment Class			
	Licensed	DTS	U-NII	DSS
Head	0.420	0.943	0.985	N/A
Body-worn	0.726	0.148	0.157	
Hotspot/Wi-Fi Direct	0.933	0.177	N/A	
Simultaneous Transmission	Head	1.407	1.407	
	Body-worn	0.865	0.857	
	Hotspot Wi-Fi Direct	0.933		

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: 
Devin Chang Senior Engineer UL Verification Services Inc.	Coltyce Sanders Laboratory Engineer 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, and TCB workshop updates:

- 447498 D01 General RF Exposure Guidance v05r02
- 648474 D04 Handset SAR v01r02
- 941225 D01 SAR test for 3G devices v02
- 941225 D02 HSPA and 1x Advanced v02r02
- 941225 D03 SAR Test Reduction GSM GPRS EDGE v01
- 941225 D04 SAR for GSM E GPRS Dual Xfer Mode v01
- 941225 D05 SAR for LTE Devices v02r03
- 941225 D06 Hotspot Mode SAR v01r01
- 248227 D01 SAR Meas for 802 11abg v01r02
- 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r03
- 865664 D02 SAR Reporting v01r01
- 690783 D01 SAR Listings on Grants v01r03

3. Facilities and Accreditation

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

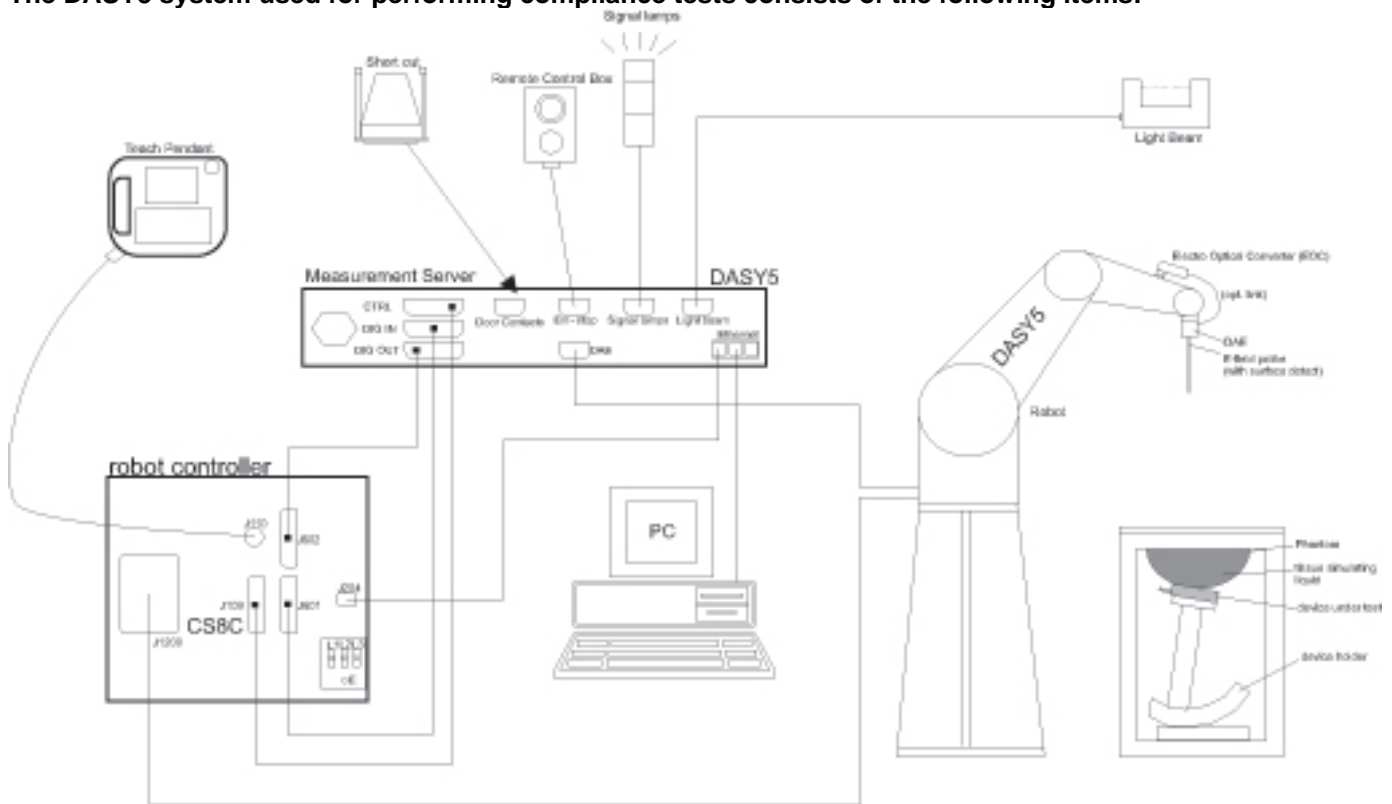
47173 Benicia Street	47266 Benicia Street
SAR Lab A	SAR Lab 1
SAR Lab B	SAR Lab 2
SAR Lab C	SAR Lab 3
SAR Lab D	SAR Lab 4
SAR Lab E	SAR Lab 5
SAR Lab F	
SAR Lab G	
SAR Lab H	

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://ts.nist.gov/standards/scopes/2000650.htm>.

4. SAR Measurement System & Test Equipment

4.1. SAR Measurement System

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



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

4.2. SAR Scan Procedure

Step 1: Power Reference Measurement

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

Step 2: Area Scan

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

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

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	$\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5$ mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	$30^\circ \pm 1^\circ$	$20^\circ \pm 1^\circ$
Maximum area scan spatial resolution: 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 \leq the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

Step 3: Zoom Scan

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

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

		≤ 3 GHz	> 3 GHz
Maximum zoom scan spatial resolution: $\Delta x_{Zoom}, \Delta y_{Zoom}$		≤ 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 1 st two points closest to phantom surface	≤ 4 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 <i>reported</i> SAR from the area scan based <i>1-g SAR estimation</i> procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.			

Step 4: Power drift measurement

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

Step 5: Z-Scan (FCC only)

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

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	E753ES	MY40000980	4/7/2015
Dielectronic Probe kit	SPEAG	DAK-3.5	1082	9/16/2015
Dielectronic Probe kit	SPEAG	DAK-3.5 Short	SM DAK 200 BA	N/A
Thermometer	Control Company	4242	122529163	10/8/2015
Thermometer	EXTECH	445703	CCS-200	3/24/2015

System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
HP Signal Generator	HP	8665B	3546A00784	6/23/2015
Power Meter	Agilent	N1911A	MY53060016	8/7/2015
Power Sensor	Agilent	E9323A	MY53070003	5/1/2015
Power Meter	HP	437B	3125U09516	10/6/2015
Power Sensor	HP	8481A	3318A95392	10/6/2015
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1622052	N/A
Bi-directional coupler	Werlatone, Inc.	C8060-102	2711	N/A
DC Power Supply	Sorensen Ametek	XT20-3	1318A00530	N/A
Synthesized Signal Generator	Agilent	8665B	3438A00633	8/29/2015
Power Meter	HP	437B	3125U11347	8/27/2015
Power Sensor	HP	8481A	1926A16917	10/10/2015
Power Meter	HP	437B	3125U16345	6/16/2015
Power Sensor	HP	8481A	2702A60780	6/16/2015
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1808938	N/A
Bi-directional coupler	Werlatone, Inc.	C8060-102	2710	N/A
DC Power Supply	HP	6296A	2841A-05955	N/A
E-Field Probe (SAR 1)	SPEAG	EX3DV4	3902	5/19/2015
E-Field Probe (SAR 3)	SPEAG	EX3DV4	3773	4/22/2015
E-Field Probe (SAR 4)	SPEAG	EX3DV4	3929	5/9/2015
E-Field Probe (SAR 5)	SPEAG	EX3DV4	3991	5/16/2015
Data Acquisition Electronics (SAR 1)	SPEAG	DAE3	427	1/21/2015
Data Acquisition Electronics (SAR 3)	SPEAG	DAE4	1380	7/23/2015
Data Acquisition Electronics (SAR 4)	SPEAG	DAE4	1377	8/27/2015
Data Acquisition Electronics (SAR 5)	SPEAG	DAE4	1439	5/14/2015
System Validation Dipole	SPEAG	D835V2	4d142	9/9/2015
System Validation Dipole	SPEAG	D1900V2	5d163	9/11/2015
System Validation Dipole	SPEAG	D2450V2	706	5/20/2015
System Validation Dipole	SPEAG	D5GHzV2	1003	2/26/2015
Thermometer (SAR Lab 1)	EXTECH	445703	CCS-205	3/24/2015
Thermometer (SAR Lab 3)	EXTECH	445703	CCS-237	6/3/2015
Thermometer (SAR Lab 4)	EXTECH	445703	CCS-238	6/3/2015
Thermometer (SAR Lab 5)	EXTECH	445703	CCS-239	6/3/2015

Others

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Base Station Simulator	R & S	CMW500	135393	7/3/2015
Power Meter	Agilent	N1912A	MY53040015	7/10/2015
Power Sensor	Agilent	N1921A	MY52020011	5/6/2015

5. Measurement Uncertainty

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

6. Device Under Test (DUT) Information

6.1. DUT Description

Model: SM-A500FU	
Device Dimension	Overall (Length x Width): 139.3 mm x 70.3 mm Overall Diagonal: 150.8 mm Display Diagonal: 127 mm
Battery Back Cover	Device has a non-removable back cover
Battery Options	Device contains a non-removal battery
Accessory	Headset
Wireless Router (Hotspot)	Wi-Fi Hotspot mode permits the device to share its cellular data connection with other Wi-Fi-enabled devices. <input checked="" type="checkbox"/> Mobile Hotspot (Wi-Fi 2.4 GHz) <input type="checkbox"/> Mobile Hotspot (Wi-Fi 5 GHz)
Wi-Fi Direct	Wi-Fi Direct enabled devices transfer data directly between each other <input checked="" type="checkbox"/> Wi-Fi Direct (Wi-Fi 2.4 GHz) <input type="checkbox"/> 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)	GSM Voice: 12.5%; GPRS/EGPRS: 1 Slot: 12.5%; 2 Slots: 25%, 3 Slots: 37.5%, 4 Slots: 50%,
		GPRS Multi-Slot Class: <input type="checkbox"/> Class 8 - One Up <input type="checkbox"/> Class 10 - Two Up <input type="checkbox"/> Class 12 - Four Up <input checked="" type="checkbox"/> Class 33 - Four Up DTM (Dual Transfer Mode): Not supported	
WCDMA (UMTS)	Band V and II	UMTS Rel. 99 (Voice & Data) HSDPA HSUPA HSPA+	100%
LTE (FDD)	Band 5	QPSK, 16QAM	100%
	Does this device SV-LTE (1xRTT-LTE)? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> 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%
Bluetooth	2.4 GHz	Version 4.0 LE	32.25% (DH1), 66.68% (DH3), 77.52% (DH5)

6.3. Nominal and Maximum Output Power

Upper limit (dB): -1.5 ~ 0.5		RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit
GSM850	Voice	33.0	33.5
	GPRS 1 slot	33.0	33.5
	GPRS 2 slots	31.5	32.0
	GPRS 3 slots	30.0	30.5
	GPRS 4 slots	28.5	29.0
	EGPRS 1 slot	27.0	27.5
	EGPRS 2 slots	26.5	27.0
	EGPRS 3 slots	26.0	26.5
GSM1900	Voice	30.0	30.5
	GPRS 1 slot	30.0	30.5
	GPRS 2 slots	28.0	28.5
	GPRS 3 slots	27.0	27.5
	GPRS 4 slots	24.5	25.0
	EGPRS 1 slot	26.5	27.0
	EGPRS 2 slots	25.5	26.0
	EGPRS 3 slots	25.0	25.5
W-CDMA Band V	R99	23.0	23.5
	HSDPA	22.0	22.5
	HSUPA	21.5	22.0
W-CDMA Band II	R99	23.0	23.5
	HSDPA	22.0	22.5
	HSUPA	22.0	22.5
LTE Band 5	QPSK	23.0	23.5

Tolerance (dB): 0.5		RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit
WiFi 2.4 GHz	802.11b	17.0	17.5
	802.11g	13.0	13.5
	802.11n HT20	12.0	12.5
WiFi 5 GHz	802.11a	13.0	13.5
	802.11n HT20	12.0	12.5
	802.11n HT40	11.0	11.5
Bluetooth		10.5	11.0
Bluetooth LE		1.0	1.5

6.4. Simultaneous Transmission Condition

RF Exposure Condition	Capable Transmit Configurations
Head	1. GSM 850/1900 Voice + Wi-Fi 2.4/5GHz 2. GSM 850/1900 (GPRS/EDGE) + Wi-Fi 2.4/5GHz 3. WCDMA Band 2/5 + Wi-Fi 2.4/5GHz 4. LTE B5+ Wi-Fi 2.4/5GHz
Body-worn Accessory	1. GSM 850/1900 Voice + Wi-Fi 2.4/5GHz 2. GSM 850/1900 Voice + BT 3. GSM 850/1900 (GPRS/EDGE) + Wi-Fi 2.4/5GHz 4. GSM 850/1900 (GPRS/EDGE) + BT 5. WCDMA Band 2/5 + Wi-Fi 2.4/5GHz 6. WCDMA Band 2/5 + BT 7. LTE B5+ Wi-Fi 2.4/5GHz 8. LTE B5+ BT
Wireless Router (Hotspot)	1. GSM 850/1900 (GPRS/EDGE) + Wi-Fi 2.4GHz 2. WCDMA Band 2/5 + Wi-Fi 2.4GHz 3. LTE B5+ Wi-Fi 2.4GHz

Notes:

- Wi-Fi 2.4GHz supports Hotspot.
- GPRS/EDGE, WCDMA and LTE support Hotspot.
- VoIP is supported in LTE, WCDMA and GPRS.
- Wi-Fi 2.4 GHz Radio cannot transmit simultaneously with Bluetooth Radio.
- Wi-Fi 5 GHz Radio cannot transmit simultaneously with Bluetooth Radio.

6.5. General LTE SAR Test and Reporting Considerations

Item	Description																																						
Frequency range, Channel Bandwidth, Numbers and Frequencies	Band 5 Frequency range: 824 - 849 MHz Channel Bandwidth 20 MHz 15 MHz 10 MHz 5 MHz 3 MHz 1.4 MHz																																						
	Low	20450/829 20425/826.5 20415/825.5 20407/824.7																																					
	Mid	20525/836.5 20525/836.5 20525/836.5 20525/836.5																																					
	High	20600/844 20625/846.5 20635/847.5 20643/848.3																																					
LTE transmitter and antenna implementation	LTE has one (1) TX/RX antennas and one (1) Diversity RX antennas Refer to Appendix A..																																						
Maximum power reduction (MPR)	<p>Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3</p> <table border="1"> <thead> <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> </thead> <tbody> <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> </tbody> </table> <p>MPR Built-in by design A-MPR (additional MPR) was disabled during SAR testing</p>	Modulation	Channel bandwidth / Transmission bandwidth (RB)						MPR (dB)	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	QPSK	>5	>4	>8	>12	>16	>18	≤ 1	16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1	16 QAM	>5	>4	>8	>12	>16	>18	≤ 2
Modulation	Channel bandwidth / Transmission bandwidth (RB)						MPR (dB)																																
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz																																	
QPSK	>5	>4	>8	>12	>16	>18	≤ 1																																
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1																																
16 QAM	>5	>4	>8	>12	>16	>18	≤ 2																																
Power reduction	No																																						
Spectrum plots for RB configurations	A properly configured 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.																																						

7. RF Exposure Conditions (Test Configurations)

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

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

Notes:

- SAR is not required because the distance from the antenna to the edge is > 25 mm as per KDB 941225 D06 Hot Spot SAR.

8. Conducted Output Power Measurements

8.1. GSM850 and GSM1900

GSM850 Measured Results

Band	Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Burst Pwr (dBm)	Frame Pwr (dBm)	
850	GSM (Voice)	CS1	1	128	824.2	33.1	24.0	
				190	836.6	33.1	24.0	
				251	848.8	33.0	24.0	
	GPRS (GMSK)	CS1	1	1	128	824.2	33.1	24.0
					190	836.6	33.1	24.0
					251	848.8	33.0	24.0
			2	1	128	824.2	31.5	25.5
					190	836.6	31.3	25.2
					251	848.8	31.2	25.2
			3	1	128	824.2	30.2	25.9
					190	836.6	30.3	26.1
					251	848.8	30.3	26.0
			4	1	128	824.2	28.7	25.7
					190	836.6	28.7	25.7
					251	848.8	28.7	25.7
	EGPRS (8PSK)	MCS5	1	1	128	824.2	26.6	17.6
					190	836.6	26.7	17.7
					251	848.8	26.8	17.7
			2	1	128	824.2	26.5	20.5
					190	836.6	26.7	20.7
					251	848.8	26.7	20.7
			3	1	128	824.2	26.5	22.2
					190	836.6	26.5	22.2
					251	848.8	26.5	22.2
4			1	128	824.2	26.2	23.2	
				190	836.6	26.2	23.2	
				251	848.8	26.2	23.2	

Notes:

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

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

GSM1900 Measured Results

Band	Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Burst Pwr (dBm)	Frame Pwr (dBm)	
1900	GSM (Voice)	CS1	1	512	1850.2	29.8	20.7	
				661	1880.0	30.1	21.1	
				810	1909.8	30.0	20.9	
	GPRS (GMSK)	CS1	1	1	512	1850.2	29.8	20.7
					661	1880.0	30.1	21.1
					810	1909.8	30.0	20.9
			2	1	512	1850.2	28.4	22.4
					661	1880.0	28.5	22.5
					810	1909.8	28.3	22.2
			3	1	512	1850.2	27.5	23.2
					661	1880.0	27.5	23.2
					810	1909.8	27.5	23.2
			4	1	512	1850.2	25.0	22.0
					661	1880.0	25.0	22.0
					810	1909.8	25.0	22.0
	EGPRS (8PSK)	MCS5	1	1	512	1850.2	25.8	16.7
					661	1880.0	26.0	17.0
					810	1909.8	25.9	16.8
			2	1	512	1850.2	25.6	19.6
					661	1880.0	25.8	19.7
					810	1909.8	25.6	19.6
			3	1	512	1850.2	25.3	21.1
					661	1880.0	25.5	21.2
					810	1909.8	25.3	21.1
4			1	512	1850.2	25.0	21.9	
				661	1880.0	25.0	22.0	
				810	1909.8	24.9	21.9	

Notes:

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

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

8.2. WCDMA Band V and II

Release 99

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

Mode	Subtest	Rel99
WCDMA General Settings	Loopback Mode	Test Mode 2
	Rel99 RMC	12.2kbps RMC
	Power Control Algorithm	Algorithm2
	β_c/β_d	8/15

Measured Results

Band	Mode	UL Ch No.	Freq. (MHz)	Avg Pwr (dBm)
WCDMA Band V	Rel 99 (RMC, 12.2 kbps)	4132	826.4	23.3
		4183	836.6	23.3
		4233	846.6	23.2
WCDMA Band II	Rel 99 (RMC, 12.2 kbps)	9262	1852.4	23.4
		9400	1880.0	23.3
		9538	1907.6	23.3

HSDPA

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
WCDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set 1			
	Power Control Algorithm	Algorithm 2			
	β_c	2/15	11/15	15/15	15/15
	β_d	15/15	15/15	8/15	4/15
	Bd (SF)	64			
	β_c/β_d	2/15	12/15	15/8	15/4
	β_{hs}	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			
$A_{hs}=\beta_{hs}/\beta_c$	30/15				

Measured Results

Band	Mode	UL Ch No.	Freq. (MHz)	MPR	Avg Pwr (dBm)
WCDMA Band V	Subtest 1	4132	826.4	0	22.3
		4183	836.6	0	22.5
		4233	846.6	0	22.4
	Subtest 2	4132	826.4	0	22.3
		4183	836.6	0	22.5
		4233	846.6	0	22.4
	Subtest 3	4132	826.4	0.5	22.0
		4183	836.6	0.5	22.0
		4233	846.6	0.5	22.0
	Subtest 4	4132	826.4	0.5	22.0
		4183	836.6	0.5	22.0
		4233	846.6	0.5	22.0
WCDMA Band II	Subtest 1	9262	1852.4	0	21.4
		9400	1880.0	0	21.4
		9538	1907.6	0	21.4
	Subtest 2	9262	1852.4	0	21.4
		9400	1880.0	0	21.4
		9538	1907.6	0	21.4
	Subtest 3	9262	1852.4	0.5	21.4
		9400	1880.0	0.5	21.4
		9538	1907.6	0.5	21.3
	Subtest 4	9262	1852.4	0.5	21.4
		9400	1880.0	0.5	21.4
		9538	1907.6	0.5	21.3

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

HSPA (HSDPA & HSUPA)

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

	Mode	HSPA				
	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
	β_c	11/15	6/15	15/15	2/15	15/15
	β_d	15/15	15/15	9/15	15/15	0
	β_{ec}	209/225	12/15	30/15	2/15	5/15
	β_c/β_d	11/15	11/15	15/9	2/15	15/0
	β_{hs}	22/15	12/15	30/15	4/15	5/15
	β_{ed}	1309/225	94/75	47/15 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				
	A _{hs} = β_{hs}/β_c	30/15				
HSUPA Specific Settings	E-DPDCCH	6	8	8	5	7
	DHARQ	0	0	0	0	0
	AG Index	20	12	15	17	21
	ETFCI (from 34.121 Table C.11.1.3)	75	67	92	71	81
	Associated Max UL Data Rate kbps	242.1	174.9	482.8	205.8	308.9
	Reference E-TFCIs	5	5	2	5	1
	Reference E-TFCI	11	11	11	11	67
	Reference E-TFCI PO	4	4	4	4	18
	Reference E-TFCI	67	67	92	67	67
	Reference E-TFCI PO	18	18	18	18	18
	Reference E-TFCI	71	71	71	71	71
	Reference E-TFCI PO	23	23	23	23	23
	Reference E-TFCI	75	75	75	75	75
	Reference E-TFCI PO	26	26	26	26	26
	Reference E-TFCI	81	81	81	81	81
Reference E-TFCI PO	27	27	27	27	27	
Maximum Channelisation Codes	2xSF2				SF4	

Measured Results

Band	Mode	UL Ch No.	Freq. (MHz)	MPR	Avg Pwr (dBm)
WCDMA Band V	Subtest 1	4132	826.4	0	22.0
		4183	836.6	0	22.0
		4233	846.6	0	22.0
	Subtest 2	4132	826.4	2	19.8
		4183	836.6	2	19.8
		4233	846.6	2	19.9
	Subtest 3	4132	826.4	1	21.0
		4183	836.6	1	21.0
		4233	846.6	1	21.0
	Subtest 4	4132	826.4	2	19.8
		4183	836.6	2	19.8
		4233	846.6	2	19.9
	Subtest 5	4132	826.4	0	22.0
		4183	836.6	0	22.0
		4233	846.6	0	22.0
WCDMA Band II	Subtest 1	9262	1852.4	0	20.7
		9400	1880.0	0	21.2
		9538	1907.6	0	20.9
	Subtest 2	9262	1852.4	2	20.4
		9400	1880.0	2	20.3
		9538	1907.6	2	20.3
	Subtest 3	9262	1852.4	1	21.1
		9400	1880.0	1	20.8
		9538	1907.6	1	21.1
	Subtest 4	9262	1852.4	2	20.4
		9400	1880.0	2	20.3
		9538	1907.6	2	20.3
	Subtest 5	9262	1852.4	0	20.7
		9400	1880.0	0	21.2
		9538	1907.6	0	20.9

8.3. LTE Band 5

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	13	10	Table 6.2.4-2	Table 6.2.4-2
	6.6.3.3.2				
NS_08	6.6.3.3.3	19	10, 15	> 44	≤ 3
NS_09	6.6.3.3.4	21	10, 15	> 40	≤ 1
				> 55	≤ 2
NS_10		20	15, 20	Table 6.2.4-3	Table 6.2.4-3
NS_11	6.6.2.2.1	23 ¹	1.4, 3, 5, 10	Table 6.2.4-5	Table 6.2.4-5
..					
NS_32	-	-	-	-	-

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

LTE Band 5 Measured Results

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)				
							829 MHz	836.5 MHz	844 MHz		
LTE Band 5	10	QPSK	1	0	0	0	23.0	22.9	23.2		
			1	25	0	0	22.8	23.0	23.1		
			1	49	0	0	22.8	23.0	23.1		
			25	0	1	1	21.9	22.0	22.1		
			25	12	1	1	21.8	22.3	22.2		
			25	25	1	1	21.7	22.2	22.1		
			50	0	1	1	21.8	22.1	22.2		
		16QAM	1	0	1	0	22.9	23.2	22.5		
			1	25	1	0	22.5	23.4	22.5		
			1	49	1	1	22.4	22.5	21.7		
			25	0	2	2	20.9	21.3	21.1		
			25	12	2	2	20.7	21.3	21.2		
			25	25	2	2	20.7	21.3	21.2		
			50	0	2	2	20.8	21.1	21.0		
Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)				
							826.5 MHz	836.5 MHz	846.5 MHz		
LTE Band 5	5	QPSK	1	0	0	1	22.8	23.0	23.0		
			1	12	0	0	22.9	23.5	23.1		
			1	24	0	1	22.6	23.0	23.0		
			12	0	1	1	22.0	22.2	22.1		
			12	6	1	1	22.0	22.2	22.1		
			12	11	1	1	21.9	22.2	22.1		
			25	0	1	1	22.1	22.2	22.1		
			16QAM	1	0	1	1	22.1	22.2	22.8	
		1		12	1	1	22.2	22.6	22.7		
		1		24	1	1	21.8	22.0	22.2		
		12		0	2	2	21.1	21.3	21.2		
		12		6	2	2	21.1	21.4	21.1		
		12		11	2	2	21.1	21.2	21.1		
		25		0	2	2	21.1	21.2	21.0		
		Band		BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)	
			825.5 MHz							836.5 MHz	847.5 MHz
LTE Band 5	3	QPSK	1	0	0	0	22.8	23.1	23.0		
			1	7	0	0	22.9	23.3	23.4		
			1	14	0	0	22.8	23.1	22.9		
			8	0	1	1	22.0	22.2	22.1		
			8	4	1	1	21.9	22.2	22.0		
			8	7	1	1	22.0	22.2	22.1		
			15	0	1	1	22.0	22.2	22.1		
			16QAM	1	0	1	0	22.9	22.9	22.5	
		1		7	1	1	22.6	22.7	22.2		
		1		14	1	1	22.5	22.2	21.9		
		8		0	2	2	21.4	20.8	21.2		
		8		4	2	2	21.1	20.9	21.2		
		8		7	2	2	21.1	21.1	21.3		
		15		0	2	2	21.1	21.3	21.1		

LTE Band 5 Measured Results (continued)

Band	BW (MHz)	Mode	RB Allocation	RB offset	Target MPR	Meas. MPR	Avg Pwr (dBm)		
							824.7 MHz	836.5 MHz	848.3 MHz
LTE Band 5	1.4	QPSK	1	0	0	0	23.0	23.1	23.1
			1	2	0	0	22.9	23.1	23.0
			1	5	0	0	23.1	23.1	23.0
			3	0	0	0	23.1	23.1	23.1
			3	1	0	0	23.2	23.1	23.1
			3	2	0	0	23.1	23.1	23.2
			6	0	1	1	22.2	22.2	22.3
		16QAM	1	0	1	0	22.6	23.2	22.7
			1	2	1	0	22.5	23.2	22.5
			1	5	1	0	23.2	23.1	22.5
			3	0	1	1	22.4	22.2	22.5
			3	1	1	1	22.4	22.3	22.1
			3	2	1	0	22.2	22.1	22.8
			6	0	2	1	21.9	22.0	21.5

8.4. Wi-Fi (2.4 GHz Band)

Required Test Channels per KDB 248227 D01

Measured Results

Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	Avg Pwr (dBm)	SAR Test (Yes/No)
2.4 (DTS)	802.11b	1 Mbps	1	2412	17.0	Yes
			6	2437	17.3	
			11	2462	17.1	
	802.11g	6 Mbps	1	2412	13.1	No
			6	2437	13.5	
			11	2462	13.5	
	802.11n (HT20)	MCS0	1	2412	12.1	No
			6	2437	12.5	
			11	2462	12.4	

Note(s):

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

Power measurements to determine worst-case data rates

Mode	Ch #	Freq. (MHz)	Data Rate	Avg Pwr (dBm)	SAR test (Yes/No)
802.11b	6	2437	1 Mbps	17.3	Yes
			2 Mbps	17.3	No
			5.5 Mbps	17.3	No
			11 Mbps	17.4	No

Note(s):

- Per KDB 248227 D01,
 - Testing at higher data rates and higher order modulations is not required when the maximum average output power for each of these configurations is < ¼ dB higher than those measured at the lowest data rate.
 - Each channel should be tested at the lowest data rate in each a-b/g mode channel BW configuration.

8.5. Wi-Fi (5 GHz Bands)

Required Test Channels per KDB 248227 D01

Measured Results

Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	Avg Pwr (dBm)	SAR Test (Yes/No)
5.2 (U-NII-1)	802.11a	6 Mbps	36	5180	13.2	Yes
			40	5200	13.3	
			44	5220	13.4	
			48	5240	13.5	
	802.11n (HT20)	MCS0	36	5180	12.0	No
			40	5200	12.2	
			48	5240	12.3	
	802.11n (HT40)	MCS0	38	5190	11.0	No
			46	5230	11.3	
5.3 (U-NII-2A)	802.11a	6 Mbps	52	5260	13.5	Yes
			56	5280	13.5	
			60	5300	13.5	
			64	5320	13.0	
	802.11n (HT20)	MCS0	52	5260	11.6	No
			60	5300	11.9	
			64	5320	12.0	
	802.11n (HT40)	MCS0	54	5270	11.5	No
			62	5310	11.4	
5.5 (U-NII-2C)	802.11a	6 Mbps	100	5500	12.8	Yes
			104	5520	12.6	
			108	5540	13.0	
			112	5560	13.5	
			116	5580	13.5	
			120	5600	12.7	
			124	5620	13.2	
			128	5640	12.7	
			100	5500	12.5	
			116	5580	12.4	
	140	5700	12.0			
	802.11n (HT20)	MCS0	102	5510	11.2	No
			110	5550	11.4	
			134	5670	11.2	
	802.11n (HT40)	MCS0	132	5660	13.4	No
136			5680	13.0		
140	5700	13.0				
5.8 (U-NII-3)	802.11a	6 Mbps	149	5745	13.4	Yes
			153	5765	12.8	
			157	5785	12.7	
			161	5805	13.4	
			165	5825	12.7	
	802.11n (HT20)	MCS0	149	5745	12.1	No
			157	5785	12.4	
			161	5805	12.3	
	802.11n (HT40)	MCS0	151	5755	10.7	No
159			5795	10.7		

Note(s):

Per KDB 248227, SAR is not required for 802.11n HT20/HT40 channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11a channels.

Power measurements to determine worst-case data rates

Band	Mode	Ch #	Freq. (MHz)	Data Rate	Avg Pwr (dBm)	SAR test (Yes/No)
5.2 GHz (U-NII-1)	802.11a	48	5240	6 Mbps	13.5	Yes
				9 Mbps	13.5	No
				12 Mbps	13.5	No
				18 Mbps	13.5	No
				24 Mbps	13.5	No
				36 Mbps	13.4	No
				48 Mbps	13.2	No
54 Mbps	13.5	No				
5.3 GHz (U-NII-2A)	802.11a	52	5260	6 Mbps	13.5	Yes
				9 Mbps	13.5	No
				12 Mbps	13.5	No
				18 Mbps	13.4	No
				24 Mbps	13.5	No
				36 Mbps	13.2	No
				48 Mbps	13.5	No
54 Mbps	13.4	No				
5.5 GHz (U-NII-2C)	802.11a	116	5580	6 Mbps	13.5	Yes
				9 Mbps	13.2	No
				12 Mbps	13.3	No
				18 Mbps	13.4	No
				24 Mbps	13.5	No
				36 Mbps	13.3	No
				48 Mbps	13.5	No
54 Mbps	13.4	No				
5.8 GHz (U-NII-3)	802.11a	149	5745	6 Mbps	13.5	Yes
				9 Mbps	13.5	No
				12 Mbps	13.5	No
				18 Mbps	13.4	No
				24 Mbps	13.5	No
				36 Mbps	13.5	No
				48 Mbps	13.4	No
54 Mbps	13.5	No				

Note(s):

- Per KDB 248227 D01,
 - Testing at higher data rates and higher order modulations is not required when the maximum average output power for each of these configurations is < ¼ dB higher than those measured at the lowest data rate.
 - Each channel should be tested at the lowest data rate in each a-b/g mode channel BW configuration.

8.6. Bluetooth

Maximum tune-up tolerance limit is 11.0 dBm. This power level qualifies for exclusion of SAR testing. Refer to Standalone SAR Test Exclusion Considerations Section below.

9. Dielectric Property Measurements

9.1. 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 Standard 1528-2013

Refer to Table 3 within the IEEE Standard 1528-2013

9.2. Dielectric Property Measurements Results

The temperature of the tissue-equivalent medium used during measurement must also be within 18°C to 25°C and within ± 2°C of the temperature when the tissue parameters are characterized.

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

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

SAR Lab 1

Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)	
11/3/2014	Head 2450	e'	37.5600	Relative Permittivity (ϵ_r):	37.56	39.20	-4.18	5
		e''	13.5400	Conductivity (σ):	1.84	1.80	2.47	5
	Head 2410	e'	37.7500	Relative Permittivity (ϵ_r):	37.75	39.28	-3.89	5
		e''	13.5200	Conductivity (σ):	1.81	1.76	2.91	5
	Head 2475	e'	37.4600	Relative Permittivity (ϵ_r):	37.46	39.17	-4.36	5
		e''	13.6600	Conductivity (σ):	1.88	1.83	2.89	5
11/3/2014	Body 2450	e'	50.2700	Relative Permittivity (ϵ_r):	50.27	52.70	-4.61	5
		e''	14.9600	Conductivity (σ):	2.04	1.95	4.51	5
	Body 2410	e'	50.4300	Relative Permittivity (ϵ_r):	50.43	52.76	-4.42	5
		e''	14.8400	Conductivity (σ):	1.99	1.91	4.25	5
	Body 2475	e'	50.2000	Relative Permittivity (ϵ_r):	50.20	52.67	-4.69	5
		e''	15.0600	Conductivity (σ):	2.07	1.99	4.40	5

SAR Lab 3

Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)	
11/17/2014	Head 835	e'	41.2800	Relative Permittivity (ϵ_r):	41.28	41.50	-0.53	5
		e''	19.7500	Conductivity (σ):	0.92	0.90	1.88	5
	Head 820	e'	41.4100	Relative Permittivity (ϵ_r):	41.41	41.60	-0.46	5
		e''	19.7500	Conductivity (σ):	0.90	0.90	0.23	5
	Head 850	e'	41.0400	Relative Permittivity (ϵ_r):	41.04	41.50	-1.11	5
		e''	19.6900	Conductivity (σ):	0.93	0.92	1.71	5
11/17/2014	Body 835	e'	53.0800	Relative Permittivity (ϵ_r):	53.08	55.20	-3.84	5
		e''	21.7500	Conductivity (σ):	1.01	0.97	4.11	5
	Body 820	e'	53.2100	Relative Permittivity (ϵ_r):	53.21	55.28	-3.74	5
		e''	21.8000	Conductivity (σ):	0.99	0.97	2.63	5
	Body 850	e'	52.9500	Relative Permittivity (ϵ_r):	52.95	55.16	-4.00	5
		e''	21.6700	Conductivity (σ):	1.02	0.99	3.75	5

SAR Lab 4

Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)	
11/17/2017	Head 1900	e'	38.2300	Relative Permittivity (ϵ_r):	38.23	40.00	-4.43	5
		e''	13.1100	Conductivity (σ):	1.39	1.40	-1.07	5
	Head 1850	e'	38.4500	Relative Permittivity (ϵ_r):	38.45	40.00	-3.87	5
		e''	13.0100	Conductivity (σ):	1.34	1.40	-4.41	5
	Head 1910	e'	38.1800	Relative Permittivity (ϵ_r):	38.18	40.00	-4.55	5
		e''	13.2500	Conductivity (σ):	1.41	1.40	0.51	5
11/17/2014	Body 1900	e'	50.8100	Relative Permittivity (ϵ_r):	50.81	53.30	-4.67	5
		e''	14.3100	Conductivity (σ):	1.51	1.52	-0.54	5
	Body 1850	e'	51.0100	Relative Permittivity (ϵ_r):	51.01	53.30	-4.30	5
		e''	14.1800	Conductivity (σ):	1.46	1.52	-4.04	5
	Body 1910	e'	50.8000	Relative Permittivity (ϵ_r):	50.80	53.30	-4.69	5
		e''	14.4000	Conductivity (σ):	1.53	1.52	0.61	5

SAR Lab 5

Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)		
11/3/2014	Head 5180	e'	36.7400	Relative Permittivity (ϵ_r):	36.74	36.01	2.02	5	
		e"	15.7000	Conductivity (σ):	4.52	4.63	-2.34	5	
	Head 5200	e'	36.7600	Relative Permittivity (ϵ_r):	36.76	35.99	2.14	5	
		e"	15.6600	Conductivity (σ):	4.53	4.65	-2.65	5	
	Head 5600	e'	36.0600	Relative Permittivity (ϵ_r):	36.06	35.53	1.48	5	
		e"	15.9100	Conductivity (σ):	4.95	5.06	-2.10	5	
	Head 5800	e'	35.8600	Relative Permittivity (ϵ_r):	35.86	35.30	1.59	5	
		e"	16.0400	Conductivity (σ):	5.17	5.27	-1.84	5	
	Head 5825	e'	35.8400	Relative Permittivity (ϵ_r):	35.84	35.30	1.53	5	
		e"	16.0300	Conductivity (σ):	5.19	5.27	-1.48	5	
	11/3/2014	Body 5180	e'	47.6500	Relative Permittivity (ϵ_r):	47.65	49.05	-2.85	5
			e"	18.4300	Conductivity (σ):	5.31	5.27	0.70	5
Body 5200		e'	47.5800	Relative Permittivity (ϵ_r):	47.58	49.02	-2.94	5	
		e"	18.3500	Conductivity (σ):	5.31	5.29	0.21	5	
Body 5600		e'	46.9100	Relative Permittivity (ϵ_r):	46.91	48.48	-3.23	5	
		e"	18.8100	Conductivity (σ):	5.86	5.76	1.67	5	
Body 5800		e'	46.5600	Relative Permittivity (ϵ_r):	46.56	48.20	-3.40	5	
		e"	18.9700	Conductivity (σ):	6.12	6.00	1.96	5	
Body 5825		e'	46.5900	Relative Permittivity (ϵ_r):	46.59	48.20	-3.34	5	
		e"	18.9000	Conductivity (σ):	6.12	6.00	2.02	5	
11/10/2014		Head 5180	e'	37.7000	Relative Permittivity (ϵ_r):	37.70	36.01	4.68	5
			e"	15.4500	Conductivity (σ):	4.45	4.63	-3.90	5
	Head 5200	e'	37.6600	Relative Permittivity (ϵ_r):	37.66	35.99	4.64	5	
		e"	15.4900	Conductivity (σ):	4.48	4.65	-3.70	5	
	Head 5600	e'	37.1700	Relative Permittivity (ϵ_r):	37.17	35.53	4.60	5	
		e"	15.8000	Conductivity (σ):	4.92	5.06	-2.78	5	
	Head 5800	e'	37.0400	Relative Permittivity (ϵ_r):	37.04	35.30	4.93	5	
		e"	15.9800	Conductivity (σ):	5.15	5.27	-2.21	5	
	Head 5825	e'	36.9200	Relative Permittivity (ϵ_r):	36.92	35.30	4.59	5	
		e"	15.8700	Conductivity (σ):	5.14	5.27	-2.46	5	
	11/10/2014	Body 5180	e'	47.3500	Relative Permittivity (ϵ_r):	47.35	49.05	-3.46	5
			e"	18.3300	Conductivity (σ):	5.28	5.27	0.15	5
Body 5200		e'	47.3600	Relative Permittivity (ϵ_r):	47.36	49.02	-3.39	5	
		e"	18.3200	Conductivity (σ):	5.30	5.29	0.04	5	
Body 5600		e'	46.8000	Relative Permittivity (ϵ_r):	46.80	48.48	-3.46	5	
		e"	18.9100	Conductivity (σ):	5.89	5.76	2.21	5	
Body 5800		e'	46.7600	Relative Permittivity (ϵ_r):	46.76	48.20	-2.99	5	
		e"	19.2100	Conductivity (σ):	6.20	6.00	3.25	5	
Body 5825		e'	46.5400	Relative Permittivity (ϵ_r):	46.54	48.20	-3.44	5	
		e"	19.1100	Conductivity (σ):	6.19	6.00	3.16	5	

10. 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.

10.1. System Performance Check Measurement Conditions

- The measurements were performed in the flat section of the TWIN SAM or ELI phantom, shell thickness: 2.0 ±0.2 mm (bottom plate) filled with Body or Head simulating liquid of the following parameters.
- The depth of tissue-equivalent liquid in a phantom must be ≥ 15.0 cm 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.

10.2. Reference Target SAR Values

The reference SAR values are obtained from the calibration certificate of system validation dipoles. The measured values are normalised to 1 Watt.

System Dipole	Serial No.	Cal. Date	Freq. (MHz)	Target SAR Values (W/kg)		
				1g/10g	Head	Body
D835V2	4d142	9/9/2014	835	1g	8.91	9.22
				10g	5.77	6.05
D1900V2	5d163	9/11/2014	1900	1g	40.8	40.60
				10g	21.2	21.4
D2450V2	706	5/20/2014	2450	1g	53.0	50.2
				10g	24.5	23.4
D5GHzV2	1003	2/26/2014	5200	1g	77.7	73.5
				10g	22.2	20.5
			5600	1g	81.8	79.6
				10g	23.2	22.1
			5800	1g	78.3	73.8
				10g	22.1	20.4

10.3. 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 1

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				
11/3/2014	D2450V2	706	Head	1g	5.40	54.0	53.00	1.89	
				10g	2.44	24.4	24.50	-0.41	
11/3/2014	D2450V2	706	Body	1g	5.44	54.4	50.20	8.37	1, 2
				10g	2.50	25.0	23.40	6.84	

SAR Lab 3

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				
11/17/2014	D835V2	4d142	Head	1g	0.929	9.29	8.91	4.26	
				10g	0.608	6.08	5.77	5.37	
11/17/2014	D835V2	4d142	Body	1g	0.966	9.66	9.22	4.77	3, 4
				10g	0.634	6.34	6.05	4.79	

SAR Lab 4

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				
11/17/2014	D1900V2	5d163	Head	1g	4.04	40.4	40.80	-0.98	
				10g	2.08	20.8	21.20	-1.89	
11/17/2014	D1900V2	5d163	Body	1g	3.76	37.6	40.60	-7.39	5, 6
				10g	1.96	19.6	21.40	-8.41	

SAR Lab 5

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				
11/3/2014	5200	1003	Head	1g	7.83	78.3	77.70	0.77	
				10g	2.25	22.5	22.20	1.35	
11/3/2014	5600	1003	Head	1g	8.65	86.5	81.80	5.75	
				10g	2.45	24.5	23.20	5.60	
11/3/2014	5800	1003	Head	1g	7.79	77.9	78.30	-0.51	
				10g	2.22	22.2	22.10	0.45	
11/3/2014	5200	1003	Body	1g	7.24	72.4	73.50	-1.50	
				10g	2.04	20.4	20.50	-0.49	
11/3/2014	5600	1003	Body	1g	8.00	80.0	79.60	0.50	
				10g	2.23	22.3	22.10	0.90	
11/3/2014	5800	1003	Body	1g	6.93	69.3	73.80	-6.10	
				10g	1.94	19.4	20.40	-4.90	
11/10/2014	5200	1003	Head	1g	8.05	80.5	77.70	3.60	
				10g	2.33	23.3	22.20	4.95	
11/10/2014	5200	1003	Body	1g	7.82	78.2	73.50	6.39	
				10g	2.20	22.0	20.50	7.32	
11/10/2014	5600	1003	Head	1g	8.87	88.7	81.80	8.44	7, 8
				10g	2.52	25.2	23.20	8.62	
11/10/2014	5600	1003	Body	1g	8.62	86.2	79.60	8.29	
				10g	2.40	24.0	22.10	8.60	
11/10/2014	5800	1003	Head	1g	8.31	83.1	78.30	6.13	
				10g	2.37	23.7	22.10	7.24	
11/10/2014	5800	1003	Body	1g	7.73	77.3	73.80	4.74	
				10g	2.16	21.6	20.40	5.88	

11. Measured and Reported (Scaled) SAR Results

SAR Test Reduction criteria are as follows:

KDB 447498 D01 General RF Exposure Guidance:

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

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

KDB 648474 D04 Handset SAR:

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

KDB 941225 D01 SAR test for 3G devices:

Body SAR is also measured for HSPA when the maximum average output of each RF channel with HSPA active is at least $\frac{1}{4}$ dB higher than that measured without HSPA using 12.2 kbps RMC or the maximum SAR for 12.2 kbps RMC is above 75% of the SAR limit. Body SAR for HSPA is measured with E-DCH Sub-test 5, using H-Set 1 and QPSK for FRC and a 12.2 kbps RMC configured in Test Loop Mode 1 with power control algorithm 2.

KDB 941225 D05 SAR for LTE Devices:

SAR test reduction is applied using the following criteria:

- Start with the largest channel bandwidth and measure SAR for QPSK with 1 RB, and 50% RB allocation, using the RB offset and required test channel combination with the highest maximum output power among RB offsets at the upper edge, middle and lower edge of each required test channel.
- When the reported SAR is > 0.8 W/kg, testing for other Channels is performed at the highest output power level for 1RB, and 50% RB configuration for that channel.
- Testing for 100% RB configuration is performed at the highest output power level for 100% RB configuration across the Low, Mid and High Channel when the highest reported SAR for 1 RB and 50% RB are > 0.8 W/kg. Testing for the remaining required channels is not needed because the reported SAR for 100% RB Allocation < 1.45 W/kg.
- Testing for 16-QAM modulation is not required because the reported SAR for QPSK is < 1.45 W/Kg and its output power is not more than 0.5 dB higher than that of QPSK.
- Testing for the other channel bandwidths is not required because the reported SAR for the highest channel bandwidth is < 1.45 W/Kg and its output power is not more than 0.5 dB higher than that of the highest channel bandwidth.

KDB 248227 D01 SAR Measurements Procedures for 802.11 a/b/g Transmitters v01r02 (pg.6):

Each channel should be tested at the lowest data rate in each a-b/g mode or 4.9 GHz channel BW configuration.

When the extrapolated maximum peak SAR for the maximum output channel is ≤ 1.6 W/kg and the 1-g averaged SAR is ≤ 0.8 W/kg, testing of other channels in the "default test channels" or "required test channels" configuration is optional.

11.1. GSM850

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Voice	0	Left Touch	190	836.6	33.5	33.1	0.158	0.173	1
			Left Tilt	190	836.6	33.5	33.1	0.128	0.140	
			Right Touch	190	836.6	33.5	33.1	0.215	0.236	
			Right Tilt	190	836.6	33.5	33.1	0.147	0.161	
Head VoIP	GPRS 3 Slots	0	Left Touch	190	836.6	30.5	30.3	0.217	0.227	2
			Left Tilt	190	836.6	30.5	30.3	0.154	0.161	
			Right Touch	190	836.6	30.5	30.3	0.307	0.321	
			Right Tilt	190	836.6	30.5	30.3	0.190	0.199	
Body-worn	Voice	10	Rear	190	836.6	33.5	33.1	0.328	0.360	3
			Front	190	836.6	33.5	33.1	0.271	0.297	
Body-worn(VoIP) & Hotspot	GPRS 3 Slots	10	Rear	190	836.6	30.5	30.3	0.532	0.557	4
Hotspot			Front	190	836.6	30.5	30.3	0.402	0.421	
			Edge 3	190	836.6	30.5	30.3	0.245	0.257	
			Edge 4	190	836.6	30.5	30.3	0.202	0.212	

11.2. GSM1900

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Voice	0	Left Touch	661	1880.0	30.5	30.1	0.153	0.168	5
			Left Tilt	661	1880.0	30.5	30.1	0.029	0.032	
			Right Touch	661	1880.0	30.5	30.1	0.145	0.159	
			Right Tilt	661	1880.0	30.5	30.1	0.040	0.044	
Head VoIP	GPRS 3 Slots	0	Left Touch	661	1880.0	27.5	27.5	0.344	0.344	6
			Left Tilt	661	1880.0	27.5	27.5	0.047	0.047	
			Right Touch	661	1880.0	27.5	27.5	0.224	0.224	
			Right Tilt	661	1880.0	27.5	27.5	0.113	0.113	
Body-worn	Voice	10	Rear	661	1880.0	30.5	30.1	0.302	0.331	7
			Front	661	1880.0	30.5	30.1	0.320	0.351	
Body-worn(VoIP) & Hotspot	GPRS 3 Slots	10	Rear	661	1880.0	27.5	27.5	0.518	0.518	8
Hotspot			Front	661	1880.0	27.5	27.5	0.575	0.575	
			Edge 3	512	1850.2	27.5	27.5	0.933	0.933	
				661	1800.0	27.5	27.5	0.857	0.857	
Edge 4	661	1880.0	27.5	27.5	0.777	0.777				

11.3. WCDMA Band V

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Rel 99 RMC	0	Left Touch	4183	836.6	23.5	23.3	0.159	0.166	10
			Left Tilt	4183	836.6	23.5	23.3	0.122	0.128	
			Right Touch	4183	836.6	23.5	23.3	0.213	0.223	
			Right Tilt	4183	836.6	23.5	23.3	0.130	0.136	
Body-worn & Hotspot	Rel 99 RMC	10	Rear	4183	836.6	23.5	23.3	0.349	0.365	11
			Front	4183	836.6	23.5	23.3	0.293	0.307	
Hotspot	Rel 99 RMC	10	Edge 3	4183	836.6	23.5	23.3	0.160	0.168	
			Edge 4	4183	836.6	23.5	23.3	0.150	0.157	

11.4. WCDMA Band II

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Rel 99 RMC	0	Left Touch	9400	1880.0	23.5	23.3	0.401	0.420	12
			Left Tilt	9400	1880.0	23.5	23.3	0.062	0.065	
			Right Touch	9400	1880.0	23.5	23.3	0.349	0.365	
			Right Tilt	9400	1880.0	23.5	23.3	0.105	0.110	
Body-worn & Hotspot	Rel 99 RMC	10	Rear	9400	1880.0	23.5	23.3	0.676	0.708	
			Front	9400	1880.0	23.5	23.3	0.693	0.726	13
Hotspot	Rel 99 RMC	10	Edge 3	9262	1852.4	23.5	23.4	0.893	0.914	14
				9400	1880.0	23.5	23.3	0.858	0.898	
				9538	1907.6	23.5	23.3	0.850	0.890	
			Edge 4	9400	1880.0	23.5	23.3	0.322	0.337	

11.5. LTE Band 5 (10MHz Bandwidth)

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	RB Allocation	RB offset	Power (dBm)		1-g SAR (W/kg)		Plot No.
								Tune-up limit	Meas.	Meas.	Scaled	
Head	QPSK	0	Left Touch	20525	836.5	1	49	23.5	23.0	0.282	0.314	15
						25	12	22.5	22.3	0.128	0.136	
			Left Tilt	20525	836.5	1	49	23.5	23.0	0.127	0.141	
						25	12	22.5	22.3	0.102	0.108	
			Right Touch	20525	836.5	1	49	23.5	23.0	0.219	0.243	
						25	12	22.5	22.3	0.163	0.173	
			Right Tilt	20525	836.5	1	49	23.5	23.0	0.139	0.155	
						25	12	22.5	22.3	0.091	0.096	
Body-worn & Hotspot	QPSK	10	Rear	20525	836.5	1	49	23.5	23.0	0.377	0.419	16
						25	12	22.5	22.3	0.282	0.299	
			Front	20525	836.5	1	49	23.5	23.0	0.299	0.332	
						25	12	22.5	22.3	0.228	0.242	
Hotspot	QPSK	10	Edge 3	20525	836.5	1	49	23.5	23.0	0.177	0.197	
						25	12	22.5	22.3	0.131	0.139	
			Edge 4	20525	836.5	1	49	23.5	23.0	0.176	0.196	
						25	12	22.5	22.3	0.142	0.150	

11.6. Wi-Fi 2.4 GHz Band (DTS)

Frequency Band	RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
							Tune-up limit	Meas.	Meas.	Scaled	
2.4 GHz	Head	802.11b 1 Mbps	0	Left Touch	1	2412.0	17.5	17.0	0.383	0.430	
					6	2437.0	17.5	17.3	0.901	0.943	17
					11	2462.0	17.5	17.1	0.605	0.663	
				Left Tilt	6	2437.0	17.5	17.3	0.651	0.682	
					Right Touch	6	2437.0	17.5	17.3	0.343	0.359
	Right Tilt	6	2437.0	17.5	17.3	0.342	0.358				
	Body-worn, Hotspot, & Wi-Fi Direct	802.11b 1 Mbps	10	Rear	6	2437.0	17.5	17.3	0.141	0.148	18
				Front	6	2437.0	17.5	17.3	0.125	0.131	
	Hotspot & Wi-Fi Direct	802.11b 1 Mbps	10	Edge 1	6	2437.0	17.5	17.3	0.169	0.177	19
				Edge 2	6	2437.0	17.5	17.3	0.039	0.041	

11.7. Wi-Fi (UNII Band)

Frequency Band	RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
							Tune-up limit	Meas.	Meas.	Scaled	
5.2 GHz (U-NII-1)	Head	802.11a 6 Mbps	0	Left Touch	48	5240.0	13.5	13.5	0.484	0.484	20
				Left Tilt	48	5240.0	13.5	13.5	0.344	0.344	
				Right Touch	48	5240.0	13.5	13.5	0.213	0.213	
				Right Tilt	48	5240.0	13.5	13.5	0.155	0.155	
	Body-worn	802.11a 6 Mbps	10	Rear	48	5240.0	13.5	13.5	0.100	0.100	21
				Front	48	5240.0	13.5	13.5	0.040	0.040	
5.3 GHz (U-NII-2A)	Head	802.11a 6 Mbps	0	Left Touch	60	5300.0	13.5	13.5	0.598	0.598	22
				Left Tilt	60	5300.0	13.5	13.5	0.566	0.566	
				Right Touch	60	5300.0	13.5	13.5	0.213	0.213	
				Right Tilt	60	5300.0	13.5	13.5	0.163	0.163	
	Body-worn	802.11a 6 Mbps	10	Rear	60	5300.0	13.5	13.5	0.080	0.080	23
				Front	60	5300.0	13.5	13.5	0.030	0.030	
5.5 GHz (U-NII-2C)	Head	802.11a 6 Mbps	0	Left Touch	116	5580.0	13.5	13.5	0.226	0.226	24
				Left Tilt	116	5580.0	13.5	13.5	0.153	0.153	
				Right Touch	116	5580.0	13.5	13.5	0.099	0.099	
				Right Tilt	116	5580.0	13.5	13.5	0.073	0.073	
	Body-worn	802.11a 6 Mbps	10	Rear	116	5580.0	13.5	13.5	0.030	0.030	25
				Front	116	5580.0	13.5	13.5	0.011	0.011	
5.8 GHz (U-NII-3)	Head	802.11a 6 Mbps	0	Left Touch	149	5745.0	13.5	13.4	0.963	0.985	
					157	5785.0	13.5	12.7	0.822	0.988	26
					161	5805.0	13.5	13.4	0.901	0.922	
				Left Tilt	149	5745.0	13.5	13.4	0.858	0.878	
					157	5785.0	13.5	12.7	0.695	0.836	
					161	5805.0	13.5	13.4	0.784	0.802	
				Right Touch	149	5745.0	13.5	13.4	0.439	0.449	
					149	5745.0	13.5	13.4	0.336	0.344	
	Body-worn	802.11a 6 Mbps	10	Rear	149	5745.0	13.5	13.4	0.153	0.157	27
				Front	149	5745.0	13.5	13.4	0.060	0.061	

11.8. Bluetooth

11.8.1. Standalone SAR Test Exclusion Considerations

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

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$, for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

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

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

Body-worn Accessory Exposure Conditions

Max. tune-up tolerance limit		Min. test separation distance (mm)	Frequency (GHz)	Result
(dBm)	(mW)			
11.0	13	10	2.480	2.0

Conclusion:

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

11.8.2. Estimated SAR

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

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

Estimated SAR Result for Body-worn Accessory Conditions:

Test Configuration	Max. tune-up tolerance limit (mW)	Min. test separation distance (mm)	Frequency (GHz)	Estimated 1-g SAR (W/kg)
Rear/Front	13	10	2.480	0.273

12. SAR Measurement Variability

In accordance with published RF Exposure KDB procedure 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 <0.8 or 2 W/kg (1-g or 10-g respectively); steps 2) through 4) do not apply.
- 2) When the original highest measured SAR is ≥ 0.8 or 2 W/kg (1-g or 10-g respectively), 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 3 (1-g or 10-g respectively) or when the original or repeated measurement is ≥ 1.45 or 3.6 W/kg (~ 10% from the 1-g or 10-g respective SAR limit).
- 4) Perform a third repeated measurement only if the original, first, or second repeated measurement is ≥ 1.5 or 3.75 W/kg (1-g or 10-g respectively) and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20 or 3 (1-g or 10-g respectively).

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	Body and Hotspot	Rear	No	0.532	N/A	N/A
	WCDMA Band V	Body and Hotspot	Rear	No	0.349	N/A	N/A
	LTE Band 5	Body and Hotspot	Rear	No	0.377	N/A	N/A
1900	GSM 1900	Hotspot	Edge 3	Yes	0.933	0.920	1.01
	WCDMA Band II	Hotspot	Edge 3	No	0.893	N/A	N/A
2400	Wi-Fi 802.11b/g/n	Head	Left Touch	Yes	0.901	0.809	1.11
5200	Wi-Fi 802.11a/n	Head	Left Touch	No	0.484	N/A	N/A
5300	Wi-Fi 802.11a/n	Head	Left Touch	No	0.598	N/A	N/A
5500	Wi-Fi 802.11a/n	Head	Left Touch	No	0.226	N/A	N/A
5800	Wi-Fi 802.11a/n	Head	Left Touch	Yes	0.963	0.916	1.05

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 .

13. Simultaneous Transmission SAR Analysis

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

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario				Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① GSM850	② Wi-Fi(DTS)	③ Wi-Fi(UNII)	④ Bluetooth		
Head	Left Touch	① + ②	0.227	0.943			1.170	No
		① + ③	0.227		0.988		1.215	No
	Left Tilt	① + ②	0.161	0.682			0.843	No
		① + ③	0.161		0.878		1.039	No
	Right Touch	① + ②	0.321	0.359			0.680	No
		① + ③	0.321		0.449		0.770	No
Right Tilt	① + ②	0.199	0.358			0.557	No	
	① + ③	0.199		0.344		0.543	No	
Body-w orn Accessory & Hotspot	Rear	① + ②	0.557	0.148			0.705	No
		① + ③	0.557		0.157		0.714	No
		① + ④	0.557			0.273	0.830	No
	Front	① + ②	0.421	0.131			0.552	No
		① + ③	0.421		0.061		0.482	No
		① + ④	0.421			0.273	0.694	No
Hotspot	Edge 1	① + ②		0.177			0.177	No
	Edge 2	① + ②		0.041			0.041	No
	Edge 3	① + ②	0.257				0.257	No
	Edge 4	① + ②	0.212				0.212	No

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

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario				Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① GSM1900	② Wi-Fi(DTS)	③ Wi-Fi(UNII)	④ Bluetooth		
Head	Left Touch	① + ②	0.344	0.943			1.287	No
		① + ③	0.344		0.988		1.332	No
	Left Tilt	① + ②	0.047	0.682			0.729	No
		① + ③	0.047		0.878		0.925	No
	Right Touch	① + ②	0.224	0.359			0.583	No
		① + ③	0.224		0.449		0.673	No
Right Tilt	① + ②	0.113	0.358			0.471	No	
	① + ③	0.113		0.344		0.457	No	
Body-w orn Accessory & Hotspot	Rear	① + ②	0.518	0.148			0.666	No
		① + ③	0.518		0.157		0.675	No
		① + ④	0.518			0.273	0.791	No
	Front	① + ②	0.575	0.131			0.706	No
		① + ③	0.575		0.061		0.636	No
		① + ④	0.575			0.273	0.848	No
Hotspot	Edge 1	① + ②		0.177			0.177	No
	Edge 2	① + ②		0.041			0.041	No
	Edge 3	① + ②	0.933				0.933	No
	Edge 4	① + ②	0.242				0.242	No

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

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario				Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① W-CDMA Band V	② Wi-Fi(DTS)	③ Wi-Fi(UNII)	④ Bluetooth		
Head	Left Touch	① + ②	0.166	0.943			1.109	No
		① + ③	0.166		0.988		1.154	No
	Left Tilt	① + ②	0.128	0.682			0.810	No
		① + ③	0.128		0.878		1.006	No
	Right Touch	① + ②	0.223	0.359			0.582	No
		① + ③	0.223		0.449		0.672	No
	Right Tilt	① + ②	0.136	0.358			0.494	No
		① + ③	0.136		0.344		0.480	No
Body-w orn Accessory & Hotspot	Rear	① + ②	0.365	0.148			0.513	No
		① + ③	0.365		0.157		0.522	No
		① + ④	0.365			0.273	0.638	No
	Front	① + ②	0.307	0.131			0.438	No
		① + ③	0.307		0.061		0.368	No
		① + ④	0.307			0.273	0.580	No
Hotspot	Edge 1	① + ②		0.177			0.177	No
	Edge 2	① + ②		0.041			0.041	No
	Edge 3	① + ②	0.168				0.168	No
	Edge 4	① + ②	0.157				0.157	No

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

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario				Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① W-CDMA Band II	② Wi-Fi(DTS)	③ Wi-Fi(UNII)	④ Bluetooth		
Head	Left Touch	① + ②	0.419	0.943			1.362	No
		① + ③	0.419		0.988		1.407	No
	Left Tilt	① + ②	0.065	0.682			0.747	No
		① + ③	0.065		0.878		0.943	No
	Right Touch	① + ②	0.365	0.359			0.724	No
		① + ③	0.365		0.449		0.814	No
	Right Tilt	① + ②	0.110	0.358			0.468	No
		① + ③	0.110		0.344		0.454	No
Body-w orn Accessory & Hotspot	Rear	① + ②	0.708	0.148			0.856	No
		① + ③	0.708		0.157		0.865	No
		① + ④	0.708			0.273	0.981	No
	Front	① + ②	0.726	0.131			0.857	No
		① + ③	0.726		0.061		0.787	No
		① + ④	0.726			0.273	0.999	No
Hotspot	Edge 1	① + ②		0.177			0.177	No
	Edge 2	① + ②		0.041			0.041	No
	Edge 3	① + ②	0.914				0.914	No
	Edge 4	① + ②	0.337				0.337	No

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

RF Exposure conditions	Test Position		Simultaneous Transmission Scenario				Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
			① LTE Band 5	② Wi-Fi(DTS)	③ Wi-Fi(UNII)	④ Bluetooth		
Head	Left Touch	① + ②	0.314	0.943			1.257	No
		① + ③	0.314		0.988		1.302	No
	Left Tilt	① + ②	0.141	0.682			0.823	No
		① + ③	0.141		0.878		1.019	No
	Right Touch	① + ②	0.243	0.359			0.602	No
		① + ③	0.243		0.449		0.692	No
	Right Tilt	① + ②	0.155	0.358			0.513	No
		① + ③	0.155		0.344		0.499	No
Body-w orn Accessory & Hotspot	Rear	① + ②	0.419	0.148			0.567	No
		① + ③	0.419		0.157		0.576	No
		① + ④	0.419			0.273	0.692	No
	Front	① + ②	0.332	0.131			0.463	No
		① + ③	0.332		0.061		0.393	No
		① + ④	0.332			0.273	0.605	No
Hotspot	Edge 1	① + ②		0.177			0.177	No
	Edge 2	① + ②		0.041			0.041	No
	Edge 3	① + ②	0.197				0.197	No
	Edge 4	① + ②	0.196				0.196	No

Conclusion:

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

14. Appendixes

Refer to separated files for the following appendixes.

- A. Photos and Antenna Locations**
- B. System Performance Check Plots**
- C. Highest SAR Test Plots**
- D. Tissue Material Ingredients**
- E. Calibration Certificates for E-Field Probes**
- F. Calibration Certificates for Dipoles**

END OF REPORT